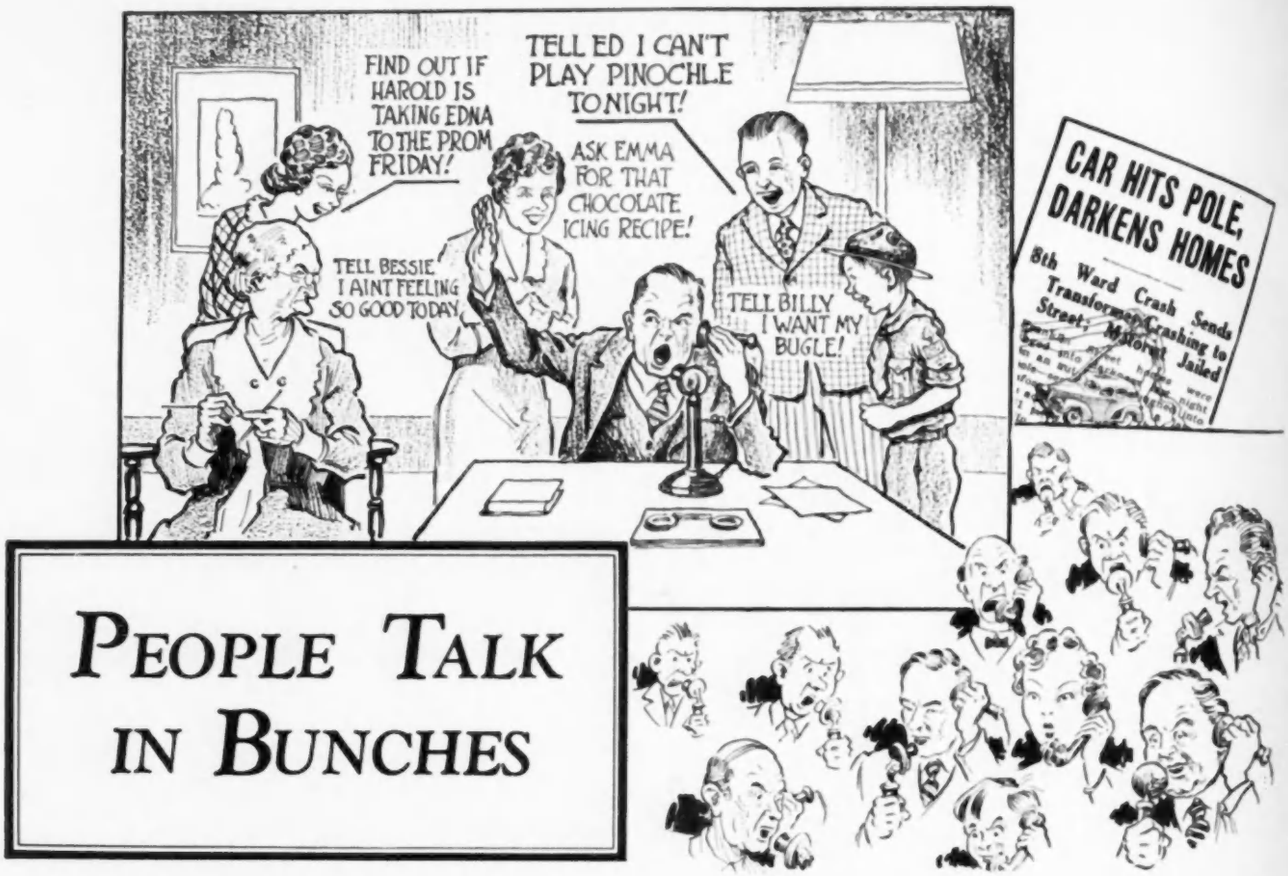
MARCH
1939

13:3

TELEPHONE ENGINEER

MANAGEMENT
ENGINEERING
MAINTENANCE

FEATURES: Short [illegible] in Telephone Transmission . . . Washington News . . . [illegible] Transmission Testing . . . Cable Corrosion

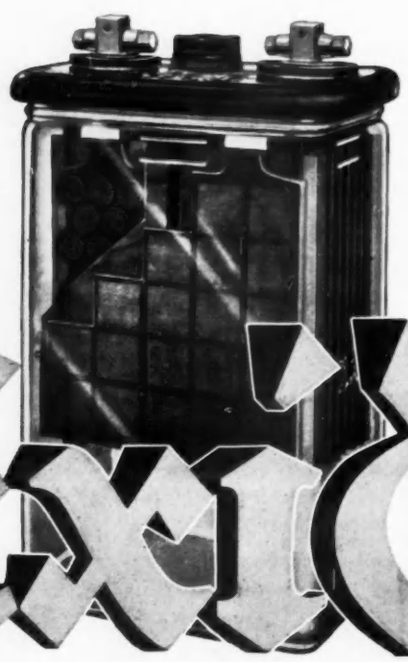

FIND OUT IF HAROLD IS TAKING EDNA TO THE PROM FRIDAY!
TELL ED I CAN'T PLAY PINOCHLE TONIGHT!
ASK EMMA FOR THAT CHOCOLATE ICING RECIPE!
TELL BESSIE I AINT FEELING SO GOOD TODAY
TELL BILLY I WANT MY BUGLE!
CAR HITS POLE, DARKENS HOMES
8th Ward Crash Sends Transformer Crashing to Street; Motorist Jailed

PEOPLE TALK IN BUNCHES

According to telephone engineers, the speech pattern of the average telephone conversation is a repetition of about six seconds of talk, then a pause. Of course, if the conversation is that of a man talking with his wife it may be six minutes of pause broken by a single syllable of speech, "yes" or "no", as the situation requires.

In the home this habit of people talking in bunches crops up even more strongly. Let someone telephone a relative or family friend and a conversational "free - for - all" usually begins, along the lines illustrated above. However, for telephone engineers a more important example of people talking in bunches occurs when some accident, storm, fire or flood suddenly disrupts electric service and throws an entire community into darkness. Then everyone grabs a telephone to find out what is wrong, or ask nearby neighbors if their lights are out too. Naturally, when an emergency starts whole communities talking at once telephone equipment is put to a severe test.

Exide Telephone Batteries can be depended upon in any emergency. Their operation is not interfered with by either interruptions or fluctuations of the A.C. supply. Their large reserve of power is always *instantly available* to handle emergency peak loads and, when necessary, keep exchange circuits *in service.* There is a dependable Exide for every telephone battery job.



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The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

The Leich Handset "Talked its Way" Into Thousands of American Homes

The success of the Leich handset has been based on its performance. In the quiet of thousands of American homes, it has received the daily test of usage — and each installation has enhanced its reputation. Each month has seen an increasing number placed in service. Although originally adopted by only a few telephone men, today it is the standard of hundreds of telephone companies.

The opportunity of discovering the merits of the Leich handset is available to all telephone companies without obligation. Merely order the type you want (common battery, magneto, or automatic) and specify a thirty day trial period. Test it, or compare it in any way you wish. The No. 90-A common battery handset is illustrated. Price, with straight-line ringer, is $17.45 F.O.B. Genoa, Ill.

LEICH SALES CORPORATION

• • • •

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RELAY

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SIMPLE · RUGGED · RELIABLE
THE RESULT OF OVER 40 YEARS EXPERIENCE

THE success of the Relaymatic is based upon the reliability of its relays . . . for relays are the heart of the equipment. All Kellogg Relays have twin contacts of precious metal. They are simple and rugged and do not require tinkering or continual supervision. These relays are typical of Kellogg design and construction and are the result of over 40 years of relay experience.

Kellogg leadership, resources and reputation back every Relaymatic installation. This assures you of a satisfactory and safe investment.

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...MATIC

Now Used in 44 States of the Union!

THE NEW MODEL 33 CALCULAGRAPH

In 14 months this new compact Calculagraph has met with complete acceptance. So outstanding are its advantages that Model 33 has been adopted by central offices in almost every State in the Union and in many provinces of Canada.

To the familiar advantages of the standard elapsed time Calculagraphs, Model 33 adds these further time and error saving features:

COMPACT—7½"x2⅜" — Takes up minimum space on switchboards.

EASY TO INSTALL—Fits most local boards.

EASY TO OPERATE—Prints elapsed time to a second on standard toll tickets.

UNOBSTRUCTED VIEW—Full vision of dial from any position on the switchboard.

SWEEP SECOND HAND—Tells the end of the initial period at a glance.

ELECTRIC—Uses less than 2 watts and stays in synchronism over a wide voltage fluctuation.

The New 33 definitely adds to the efficiency and smoothness of central office. Write for price and booklet 22.

THE CALCULAGRAPH COMPANY
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CALCULAGRAPH

THE ELAPSED TIME RECORDER

Reg. U. S. Pat. Off.

THE 1212 HANDSET!

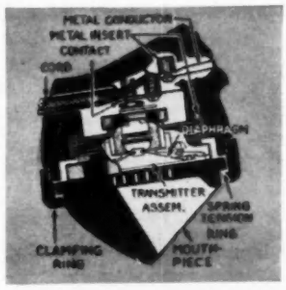
During 1938, Stromberg-Carlson's sales of telephone instruments were the biggest ever known in the company's history. A prominent contributing factor was the 1212 Handset, proved to be a leader in the field by the fact that many operating companies have chosen it in competition with lower-priced instruments.

The 1212 Handset is completely self-contained with induction coil, condenser and two-tone gongs mounted in the base of the instrument. It eliminates the necessity for defacing walls with a separate bell box.

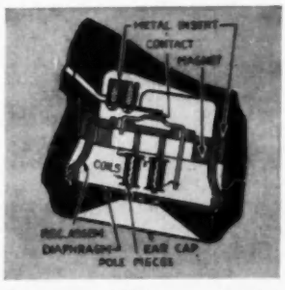
Order a sample of the Stromberg-Carlson 1212 Handset. You will see why it is a sales builder for many operating companies.

The Stromberg-Carlson 1212 Handset unit is so well balanced that it can be used for long periods without tiring the subscriber. Its appearance blends harmoniously with the most modern surroundings.

The design of the 1212 Handset permits an easy grasp of the instrument which makes it convenient for even the most delicate feminine hand to lift. Moreover, the Handset is about 50% lighter than most self-contained instruments.



The transmitter employs the conical shaped diaphragm of the radio speaker which causes its center to move as a rigid unit with a piston motion. Annular corrugations near the outer edge give a maximum flexibility with the same effort.



A feature of the receiver is the firm clamping of the diaphragm without excessive tension which is insured at all times by the ear cap's thread being entirely independent of the receiver's mounting thread.

Stromberg-Carlson Telephone Mfg. Co., Factory and General Offices: 100 Carlson Road, Rochester, N. Y., U. S. A., Branch Offices: Chicago, Kansas City, San Francisco, Toronto

Stromberg-Carlson

WHEN people are asked to guess the cost of Long Distance telephoning, they usually guess high! The advertisement on the opposite page helps correct this impression. It appears during March in general magazines. It tells the story of low-cost Long Distance calls in picture, headline and text.

The list of typical rates has been carefully drawn up to emphasize the low-cost story in various sections of the country. Such advertising should benefit the whole telephone industry.

AN ADVERTISEMENT OF THE BELL TELEPHONE SYSTEM

50¢ will take you 150 miles BY TELEPHONE
EVERY EVENING AFTER SEVEN AND ALL DAY SUNDAY
EVENING and all day Sunday bargain hours make it easier than ever to visit those who are dear but distant . . . by telephone.
Then a personal chat with the folks back home, a boy at school, or a far-away invalid, is almost as satisfying as seeing them. It's inexpensive too.
Try a friendly call tonight or on Sunday. Some typical rates between cities are shown at the right. Many more are listed in the front of your telephone directory.
Remember, when you call, that the pleasure you give is as great as the pleasure you receive.
HERE'S HOW LITTLE IT COSTS TO TELEPHONE:
BETWEEN THESE POINTS
DAY except SUNDAY*
NIGHT and SUNDAY*
Boston, Mass. - - - - Hartford, Conn. - - - $ .50 $ .35
Little Rock, Ark. - - - - Shreveport, La. - - - .75 .45
Butte, Mont. - - - - Spokane, Wash. - - - 1.00 .60
Atlanta, Ga. - - - - Memphis, Tenn. - - - 1.20 .75
Oklahoma City, Okla. St. Louis, Mo. - - - 1.50 .90
Dayton, Ohio - - - - New York, N. Y. - - - 1.70 1.05
Salt Lake City, Utah San Francisco, Calif. 1.80 1.10
Chicago, Ill. - - - - Philadelphia, Pa. - - - 2.00 1.20
* 3-minute station-to-station rates. Reduced rates are in effect from 7 P.M. to 4:30 A.M. every night and all day on Sunday.

Notifications from Messrs. George Butler of Texas, "Hube" Hubenthal of Oklahoma, and H. B. Couch of Kansas, secretaries of their state telephone associations reminds us that state convention time is with us. They start in Texas on March 22 and follow in rapid succession in Oklahoma and Kansas. April, May and June will be active farther north. We hope to attend some or all of these and advise our readers to prepare now to attend their state convention. Complete schedule is carried in this issue.

▼

Naturally the most important subject will be on the Wage-Hour situation and what is to be done about it. This is a problem that is hitting right at the pocketbook and must be remedied for many companies to remain in business. The manufacturer and suppliers are exhibiting the newest and latest developments of your industry so do not fail to attend your state meeting.

▼

Our thanks to C. F. Mason, the genial president of the Associated Telephone Co., Ltd. of Santa Monica, Cal., for the first copies of their company publication, 'The Associated Circle'. It is attractive and readable. It also reminds us to thank E. R. Hannibal, of the apple state of Washington for sending us their newsy publication, 'Crosstalk'. To you both, congratulations!

TELEPHONE ENGINEER

MANAGEMENT · ENGINEERING · MAINTENANCE

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A Magazine devoted to the interests of the entire telephone industry—operating men and manufacturers.

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Founded in 1909

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"IN BUSINESS SINCE 1904"

An Association Letter to All Independents . . .

THE OPENING of the Golden Gate Exposition on February 11 and the impending opening of the New York Worlds' Fair of 1939, reminds us of the great benefits to the telephone industry which will doubtless come through the activity of the Bell Telephone System in providing at each of these expositions, buildings for the education of the public, telephonically speaking, and in this activity the Independent telephone industry is pleased with the privilege of cooperating.

In addition to many interesting exhibits which have been provided, including the Voder, which speaks mechanically when manually operated. Free long distance telephone service will be furnished with the special cooperation of we Independents. Such a service was furnished at the recent Worlds Fair in Chicago, but at that time calls were restricted to Bell operated territory; now, however, restrictions have been eliminated so that our Independent patrons, as well as those using the Bell System, will be able to talk home and deliver the usual message of "We are having a fine time — wish you were here."

Independent telephone operators should give special consideration to this class of service because of the great demand there will be for it due to its unusual conditions and the fact that it costs the user nothing. It's unusual value as a medium advertising long distance service for the entire telephone industry is obvious.

Many of you will visit these Expositions and should arrange to give the telephone exhibit your concentrated attention. Further, the suggestion is made that you notify your local papers that you are cooperating in these services. When at the Exposition make your position in the industry known to those in charge of the exhibit.

Very truly yours,

U. S. INDEPENDENT TELEPHONE ASS'N.

Lamb Pitcher

Executive Vice-President

HIGH STRENGTH *plus Low Resistance*

Crapo
HTL—85
TELEPHONE WIRE

REG. U.S. PAT. OFF.

Manufacturers of
***Crapo* Galvanized Telephone Wire and Steel Strand**

You now can build *better* telephone lines than ever before—at lower cost.

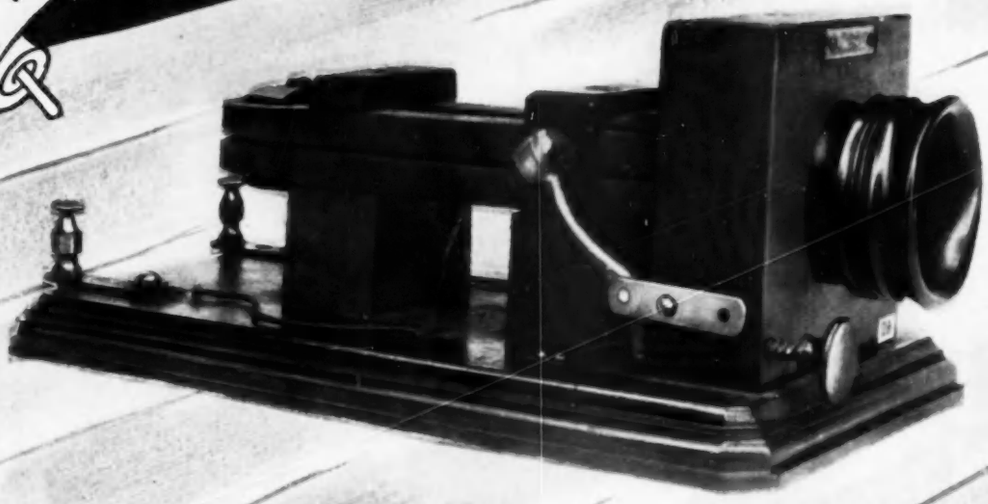
Specify ***Crapo*** HTL-85, the new, high-tensile, low-resistance, galvanized Line Wire! Its high strength makes possible *longer* spans, with fewer pole structures, on new construction; provides *stronger* spans, increases the factor of safety, on existing lines of standard span length.

Crapo HTL-85, because of this extra strength, withstands heavier ice and wind loading, minimizes service interruption, reduces maintenance expense. Its telephonic characteristics are superior to the usual accepted standards. Transmission losses are low. Signaling qualities are excellent.

The development of ***Crapo*** HTL-85 Line Wire, after years of research, marks the most revolutionary advance in the manufacture of ferrous telephone wire since the inception of the industry. Technical information and data are available in bulletin form. Write—

INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

THE STORY OF THE TELEPHONE IS THE STORY OF PROGRESS



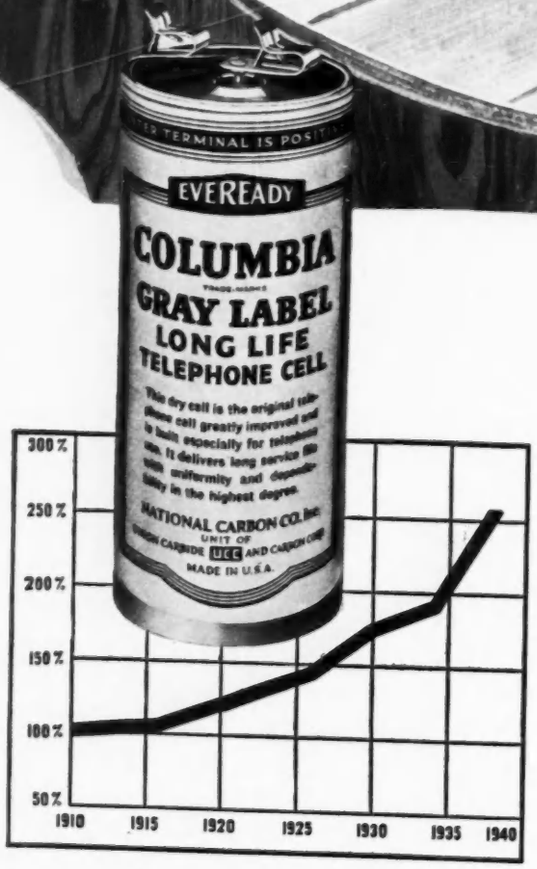
WATSON'S 'THUMPER' "...Did it better"

This is one of a series ... memorating the long ... bringing voice transmission ... a theory to its present dep... bility and clarity. For the ... and photograph here we are ... debted to the Bell System ... torical Museum and Cre... W. C. F. Farnell.

ONE "BUG" confronting the telephone man of 1877 was how ... call a person to a distant telephone. Tapping the end of a pencil on ... diaphragm was the first expedient of the caller. Unfortunately, ... tinued tapping damaged the diaphragm.

Thomas A. Watson, Alexander Graham Bell's laboratory assista... solved this problem by designing a hammer, operated by a push b... ton, to strike the diaphragm on its edge. This produced a louder sou... and eliminated this diaphragm casualty.

This incident is typical of a never-ending search by the telepho... industry ... in full swing today as in the early days of the telephone ... to find ways to "Do it better."



YARDSTICK OF TELEPHONE BATTERY POWER

Hand in hand with the telephone has gone the improvement of "Eveready" telephone power. For example, the famous "Eveready" "Columbia" "Gray Label" Long-Life Telephone Cell today gives you two-and-a-half times the service of the best cell you could buy in 1910.

And, in the world's greatest battery laboratory ... for more power for less money continues

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TELEPHONE ENGINEER
MANAGEMENT · ENGINEERING · MAINTENANCE

MARCH, 1939

"Tapping In"

On Washington

By ROLAND C. DAVIES
Editor
Telecommunications Reports

THE Independent Telephone industry has achieved excellent progress in securing Congressional consideration of the threatening financial burden upon the exchanges in the smaller cities and towns and rural areas through the wages and hours provisions of the Fair Labor Standards Act. Congress planned to start its study of the problem on the Senate side of the Capitol with a hearing, scheduled for March 23, before the Senate Education and Labor Committee on the Herring Bill which exempts from that statute exchanges of 1,000 or less subscribers.

The chances of Congressional approval of the legislation to exempt the telephone exchanges with 1,000 or less subscribers appear rather good. With the present trend of the "business appeasement" policy by President Roosevelt and his Administration, the proposal to relieve the telephone exchanges in the small cities and towns and rural regions from the minimum wage and maximum hour burdens is felt to be in line with that program. Congress now has the attitude presented in a complete and excellent fashion. As a result, Congress decided to give careful consideration to these problems of the telephone industry, because of the dangers of the wages and hours provisions in threatening the curtailment of service in many places and even the closing down of exchanges.

THE issue of the Wage-Hour law's revision presents for the telephone industry not only the most important immediate results but also the greatest significance for the future, because of the steadily rising minimum wage and maximum hours of work requirements during the next six years, of any question now appearing in the Federal Government "arena." It eclipses in importance for the telephone industry the turbulent course of the Federal Communications Commission and the proposals now pending in Congress for the reorganizing of that agency and for its investigation.

Hearings on the FCC Reorganization bill still have not been scheduled by Chairman Wheeler of the Senate Interstate Commerce Committee. The situation in regard to the FCC's shakeup, launched with a three-member Commission plan which was sponsored by FCC Chairman Frank R. McNinch with a purported "blessing" of President Roosevelt, has been expanded with the introduction of a bill to provide for a board of 11 members by Senator Wallace White of Maine, ranking Republican on the Senate Interstate Commerce Committee which is rated as the leading authority on communications and radio in Congress. The White bill proposes the establishment of two autonomous divisions in the Commission—one for radio regulation and the other to handle communications.

However, so far there appears little likelihood of reorganization legislation passing at this session of Congress. The Senate is not much interested in the proposal and the House is entirely apathetic to it.

The Congressional mind, in fact, is turning towards the idea of a thorough investigation of the Communications Commission. Senator White has introduced a resolution which would have the Senate Interstate Commerce Committee conduct such a probe that would be centered on the FCC's internal strife, failures of functioning, radio broadcasting regulatory policies and one major communications subject, the merger of wire and radio telegraph companies both in the domestic and international fields. In the House there are two pending resolutions calling for an investigation, sponsored by Rep. Connery, a Democrat, and Rep. Wigglesworth, Republican, both of Massachusetts, but the House leadership so far has not been disposed to give these proposals any right of way.

State Commissions Support Exemption of Telephone Exchanges from Wages-Hours Law

Calling upon the impartial State Commissions, the governmental agencies which regulate the practice and rates of the telephone industry, the Wages-Hours Administration has learned from practically every state agency that the exemption

of telephone operators in exchanges of 1,000 or less subscribers is necessary for the maintenance of the present extensive coverage of the country in telephone service.

THE fact that the State Commissions with only a few exceptions endorsed the Herring Bill was secured by the Wages-Hours Administration after it had disseminated questionnaires about their views. Because the State Commissions represent a disinterested, unbiased viewpoint and are entirely familiar with the financial needs of the telephone companies operating in the small cities, towns and rural areas, this almost unanimous support of the exemption proposal *should mean that the Wages-Hours Administration is virtually obliged to transmit to the Senate a report favoring the enactment of the Herring amendment.*

The Wages-Hours Committee of the United States Independent Telephone Association, headed by Chairman John H. Agee, and Vice-Chairman E. C. Blomeyer together with many leading Association officials topped by Association President B. L. Fisher of the Lee (Va.) Telephone Co. and executives of telephone companies, has performed with notable success the difficult task of acquainting members of Congress and Federal Government officials with the facts about the Independent industry to secure the introduction of the proper amendatory legislation. Now the task ahead is the preparation for the Senate Committee hearings. While the Independent telephone companies have transmitted to individual Senators and Congressmen the facts about their operations as affected by the Wages-Hours law in support of an amendment, the work of preparing for the hearings makes the continuation of the dispatching of such information to the Senate Committee and other members of Congress of paramount necessity if the legislation is to receive proper consideration at this session.

Two hazards in the path of the successful culmination of the 1,000 subscriber exchange exemption through Congressional enactment are apparent. First, the Wages-Hours Administration may be slow in transmitting its report on the Herring Bill to the Senate Labor Committee which would postpone hearings until April. Then, and more important, President Roosevelt has signified his desire to have an early adjournment of Congress and this latter objective might mean that with hearings late in the session on the Herring Bill the telephone exemption measure could easily be shunted aside in the legislative jam which always characterizes the ending of a session of Congress.

WAGES-HOURS Administrator Andrews, who with his leading assistants has given careful and sympathetic consideration to the problem of the Independent telephone industry and in a recent press statement stressed that he was concerned with the problems of small exchanges and would regret any discontinuance or curtailment of service, has indicated that he was not averse to some amendment of the Fair Labor Standards Act to exempt the high-salaried "white collar" workers from the maximum hours of work provisions. Whether Mr. Andrews in supporting this proposed revision of his law would approve the proposed telephone industry exemption is not known, but the fact that he was willing to favor one revision would appear to open the way for other meritorious amendments.

Administrator Andrews, after he had received many scores of letters from members of Congress asking about the situation of the telephone industry under his law, issued a public statement which summarized the work of his Division in

(Please turn to page 26)

Convention Schedule

Texas Telephone Association, Baker Hotel, Dallas, March 22, 23 and 24.

Oklahoma Telephone Association, Huckins Hotel, Oklahoma City, March 27 and 28.

Kansas Telephone Association, Municipal Auditorium, Junction City, March 30 and 31.

Missouri Telephone Association, Hotel Muehlebach, Kansas City, April 3 and 4.

Nebraska Telephone Association, Lincoln Hotel, Lincoln, April 11 and 12.

Iowa Independent Telephone Association, Fort Des Moines Hotel, Des Moines, April 18, 19 and 20.

Ohio Independent Telephone Association, Deshler-Wallick Hotel, Columbus, April 25 and 26.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 10 and 11.

Conference of class A and B member companies, U. S. Independent Telephone Association, Chicago, Stevens Hotel, May 15 and 16.

Pennsylvania Independent Telephone Association, Yorktowne Hotel, York, May 18, 19 and 20.

New York State Telephone Association, Hotel Syracuse, Syracuse, May 23, 24, 25 and 26.

The Illinois Telephone Association, Pere-Marquette Hotel, Peoria, June 7 and 8.

Wisconsin State Telephone Association and Wisconsin Locally Owned Telephone Group, Park Hotel, Madison, June 13-15.

CONVENTION GOSSIP

A letter from Sam H. Shutt of Sherman, Texas, reminds us to bring our golf clubs to the Texas Telephone Association Convention to be held in Dallas, March 22, 23 and 24. The tournament will be held at the Lakewood Country Club, the same place were it was held last year. Sam insists the bad weather that cut attendance last year was "unseasonable" and would not dare repeat. A dinner will follow at the clubhouse.

During the bad weather of the tournament last year many players did not show up. In fact every one that played received a prize except Dick Cole of the Automatic. He did alright at the banquet following we understand.

President Oscar Burton of the Texas Association informs us he considers the 1939 convention as the most important of many years. With George Butler, secretary, in active assistance, the arranged program will be devoted to all phases and problems of the industry. The Wage-Hour discussion will receive much importance at this session.

Another golf tournament at Oklahoma City on March 26 will start festivities of the Oklahoma Telephone Association to be held March 27 and 28, according to "Hube" Hubenthal, secretary of the association. Immediately following the Oklahoma convention the Kansas association will hold their meeting on March 30 and 31, at Junction City, Kansas.

We especially urge the members of state associations to attend their 1939 convention and hear what has been done about the Wage-Hour Act, the R.E.A. situation and state legislative problems now coming up.

Daniel McNulty, manager of the Telephone Repair Company, Chicago, is taking no chances in missing out on the golf in Texas as he has already notifed Sam Shutt of his entry. Reliable Electric's George Rodormer is already practicing his swing and rumor has it that Stromberg-Carlson's Gene Reinke might be a real "dark horse" of the tournament. In fact, the entire industry's suppliers should be represented *en masse.*

Telephone Transmission TESTING

By
RAY BLAIN

The tone generator connected to a cable pair on the main frame.

THE need of good transmission has increased steadily during the past years until now it has reached such a degree of perfection that no telephone company can well afford to neglect or under estimate its importance. There was a time when toll calls rarely extended outside the county and almost any grade of transmission was considered passable. Those days are gone forever and now a call may, and frequently does, originate on an ordinary rural line and extend half way around the globe. On a call of this nature large transmission losses on the rural line section of the circuit could ruin the transmission of the call despite the use of modern equipment on the remainder of the line. That a chain is no stronger than its weakest link, likewise proves true of any long telephone circuit. We firmly believe that no telephone company favored with toll connections can well afford to risk conditions on their portion of the line which could ruin an important and perhaps an international telephone conversation.

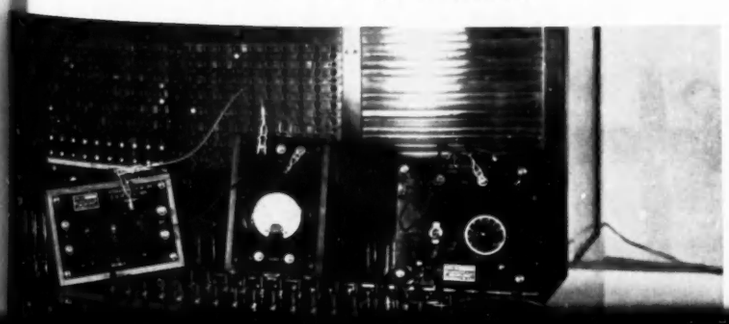
There was a time, vivid still in the minds of many men now living, when the telephone was used primarily for social and amusement purposes and correct word for word transmission was not ordinarily considered absolutely essential. This is no longer true for now business of great importance is transacted over the telephone and the loss or misunderstanding of a single word could cost considerable and bring disfavor to the telephone. There appears to be no doubt that the day of high fidelity telephone transmission has arrived and we must all make a real effort to keep up with the parade. The superior quality of radio and the movies have done much to educate people and cause them to expect near perfect telephone transmission of the spoken word. Back in the old days when the tin morning glory horn scratched out "Break the news to Mother" from a wheezy old cylinder phonograph people did not expect quality of speech from their telephone. Now with near perfection in reproduction over the radio, movies, and public address systems people are schooled to expect the same quality when they use their telephones regardless of the length of circuit over which they are talking.

TO meet the ever growing demand for better telephone transmission manufacturers have accomplished wonders in the improvement of their supplies, equipment and testing apparatus. The average telephone instrument of today is far superior to the best of only a few years past. All connecting equipment has also been redesigned with a view of keeping transmission losses to an absolute minimum. Better materials and the observance of improved construction methods have provided outside lines of maximum efficiency.

While this modern high efficiency equipment has been made available to all at a most reasonable cost, to realize its maximum benefit it must likewise be maintained in such a manner as to insure its continued efficiency at all times. The accurate location of transmission losses cannot be obtained by old and ordinarily used tests although its detection is simple by use of modern test equipment. These direct reading transmission testing instruments will prove a real pleasure to any progressive telephone man and will be of lasting benefit in any well maintained exchange.

This was not true in the past when the location of transmission trouble was most difficult and the purchase of the minimum required equipment cost thousands of dollars. This equipment was never within the means of the average small or even medium sized independent telephone company so few were ever able to benefit by its use. Likewise this equipment at best was complicated and considerable calculating was required to convert its reading into terms which could be used to advantage. With these old sets results were generally obtained by balancing a tone or a testers voice when talking in a normal tone and as all human voices and ears vary considerable the result often left a lot to be desired. The only alternative for the hard pressed Independent Telephone man was to guess and we all know that telephone guessing is generally an expensive process. As a result transmission trouble in the smaller exchanges generally represented considerable loss of both time and money with the service suffering in general.

The Attenuation Box, Decibel Meter and tone generator being used to test cord circuits on a multiple switchboard.



The decibel meter being used in the field. Mr. Mitchell, engineer for the Shallcross Mfg. Co., on left and Mr. Starkweather, engineer for the Signal Corps, on the right.

of telephone operators in exchanges of 1,000 or less subscribers is necessary for the maintenance of the present extensive coverage of the country in telephone service.

THE fact that the State Commissions with only a few exceptions endorsed the Herring Bill was secured by the Wages-Hours Administration after it had disseminated questionnaires about their views. Because the State Commissions represent a disinterested, unbiased viewpoint and are entirely familiar with the financial needs of the telephone companies operating in the small cities, towns and rural areas, this almost unanimous support of the exemption proposal *should mean that the Wages-Hours Administration is virtually obliged to transmit to the Senate a report favoring the enactment of the Herring amendment.*

The Wages-Hours Committee of the United States Independent Telephone Association, headed by Chairman John H. Agee, and Vice-Chairman E. C. Blomeyer together with many leading Association officials topped by Association President B. L. Fisher of the Lee (Va.) Telephone Co. and executives of telephone companies, has performed with notable success the difficult task of acquainting members of Congress and Federal Government officials with the facts about the Independent industry to secure the introduction of the proper amendatory legislation. Now the task ahead is the preparation for the Senate Committee hearings. While the Independent telephone companies have transmitted to individual Senators and Congressmen the facts about their operations as affected by the Wages-Hours law in support of an amendment, the work of preparing for the hearings makes the continuation of the dispatching of such information to the Senate Committee and other members of Congress of paramount necessity if the legislation is to receive proper consideration at this session.

Two hazards in the path of the successful culmination of the 1,000 subscriber exchange exemption through Congressional enactment are apparent. First, the Wages-Hours Administration may be slow in transmitting its report on the Herring Bill to the Senate Labor Committee which would postpone hearings until April. Then, and more important, President Roosevelt has signified his desire to have an early adjournment of Congress and this latter objective might mean that with hearings late in the session on the Herring Bill the telephone exemption measure could easily be shunted aside in the legislative jam which always characterizes the ending of a session of Congress.

WAGES-HOURS Administrator Andrews, who with his leading assistants has given careful and sympathetic consideration to the problem of the Independent telephone industry and in a recent press statement stressed that he was concerned with the problems of small exchanges and would regret any discontinuance or curtailment of service, has indicated that he was not averse to some amendment of the Fair Labor Standards Act to exempt the high-salaried "white collar" workers from the maximum hours of work provisions. Whether Mr. Andrews in supporting this proposed revision of his law would approve the proposed telephone industry exemption is not known, but the fact that he was willing to favor one revision would appear to open the way for other meritorious amendments.

Administrator Andrews, after he had received many scores of letters from members of Congress asking about the situation of the telephone industry under his law, issued a public statement which summarized the work of his Division in

(Please turn to page 26)

Convention Schedule

Texas Telephone Association, Baker Hotel, Dallas, March 22, 23 and 24.

Oklahoma Telephone Association, Huckins Hotel, Oklahoma City, March 27 and 28.

Kansas Telephone Association, Municipal Auditorium, Junction City, March 30 and 31.

Missouri Telephone Association, Hotel Muehlebach, Kansas City, April 3 and 4.

Nebraska Telephone Association, Lincoln Hotel, Lincoln, April 11 and 12.

Iowa Independent Telephone Association, Fort Des Moines Hotel, Des Moines, April 18, 19 and 20.

Ohio Independent Telephone Association, Deshler-Wallick Hotel, Columbus, April 25 and 26.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 10 and 11.

Conference of class A and B member companies, U. S. Independent Telephone Association, Chicago, Stevens Hotel, May 15 and 16.

Pennsylvania Independent Telephone Association, Yorktowne Hotel, York, May 18, 19 and 20.

New York State Telephone Association, Hotel Syracuse, Syracuse, May 23, 24, 25 and 26.

The Illinois Telephone Association, Pere-Marquette Hotel, Peoria, June 7 and 8.

Wisconsin State Telephone Association and Wisconsin Locally Owned Telephone Group, Park Hotel, Madison, June 13-15.

CONVENTION GOSSIP

A letter from Sam H. Shutt of Sherman, Texas, reminds us to bring our golf clubs to the Texas Telephone Association Convention to be held in Dallas, March 22, 23 and 24. The tournament will be held at the Lakewood Country Club, the same place were it was held last year. Sam insists the bad weather that cut attendance last year was "unseasonable" and would not dare repeat. A dinner will follow at the clubhouse.

During the bad weather of the tournament last year many players did not show up. In fact every one that played received a prize except Dick Cole of the Automatic. He did alright at the banquet following we understand.

President Oscar Burton of the Texas Association informs us he considers the 1939 convention as the most important of many years. With George Butler, secretary, in active assistance, the arranged program will be devoted to all phases and problems of the industry. The Wage-Hour discussion will receive much importance at this session.

Another golf tournament at Oklahoma City on March 26 will start festivities of the Oklahoma Telephone Association to be held March 27 and 28, according to "Hube" Hubenthal, secretary of the association. Immediately following the Oklahoma convention the Kansas association will hold their meeting on March 30 and 31, at Junction City, Kansas.

We especially urge the members of state associations to attend their 1939 convention and hear what has been done about the Wage-Hour Act, the R.E.A. situation and state legislative problems now coming up.

Daniel McNulty, manager of the Telephone Repair Company, Chicago, is taking no chances in missing out on the golf in Texas as he has already notifed Sam Shutt of his entry. Reliable Electric's George Rodormer is already practicing his swing and rumor has it that Stromberg-Carlson's Gene Reinke might be a real "dark horse" of the tournament. In fact, the entire industry's suppliers should be represented *en masse.*

Telephone Transmission

TESTING

By
RAY BLAIN

The tone generator connected to a cable pair on the main frame.

THE need of good transmission has increased steadily during the past years until now it has reached such a degree of perfection that no telephone company can well afford to neglect or under estimate its importance. There was a time when toll calls rarely extended outside the county and almost any grade of transmission was considered passable. Those days are gone forever and now a call may, and frequently does, originate on an ordinary rural line and extend half way around the globe. On a call of this nature large transmission losses on the rural line section of the circuit could ruin the transmission of the call despite the use of modern equipment on the remainder of the line. That a chain is no stronger than its weakest link, likewise proves true of any long telephone circuit. We firmly believe that no telephone company favored with toll connections can well afford to risk conditions on their portion of the line which could ruin an important and perhaps an international telephone conversation.

There was a time, vivid still in the minds of many men now living, when the telephone was used primarily for social and amusement purposes and correct word for word transmission was not ordinarily considered absolutely essential. This is no longer true for now business of great importance is transacted over the telephone and the loss or misunderstanding of a single word could cost considerable and bring disfavor to the telephone. There appears to be no doubt that the day of high fidelity telephone transmission has arrived and we must all make a real effort to keep up with the parade. The superior quality of radio and the movies have done much to educate people and cause them to expect near perfect telephone transmission of the spoken word. Back in the old days when the tin morning glory horn scratched out "Break the news to Mother" from a wheezy old cylinder phonograph people did not expect quality of speech from their telephone. Now with near perfection in reproduction over the radio, movies, and public address systems people are schooled to expect the same quality when they use their telephones regardless of the length of circuit over which they are talking.

TO meet the ever growing demand for better telephone transmission manufacturers have accomplished wonders in the improvement of their supplies, equipment and testing apparatus. The average telephone instrument of today is far superior to the best of only a few years past. All connecting equipment has also been redesigned with a view of keeping transmission losses to an absolute minimum. Better materials and the observance of improved construction methods have provided outside lines of maximum efficiency.

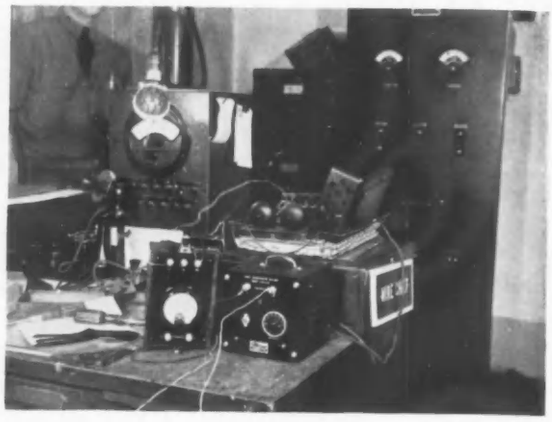
While this modern high efficiency equipment has been made available to all at a most reasonable cost, to realize its maximum benefit it must likewise be maintained in such a manner as to insure its continued efficiency at all times. The accurate location of transmission losses cannot be obtained by old and ordinarily used tests although its detection is simple by use of modern test equipment. These direct reading transmission testing instruments will prove a real pleasure to any progressive telephone man and will be of lasting benefit in any well maintained exchange.

This was not true in the past when the location of transmission trouble was most difficult and the purchase of the minimum required equipment cost thousands of dollars. This equipment was never within the means of the average small or even medium sized independent telephone company so few were ever able to benefit by its use. Likewise this equipment at best was complicated and considerable calculating was required to convert its reading into terms which could be used to advantage. With these old sets results were generally obtained by balancing a tone or a testers voice when talking in a normal tone and as all human voices and ears vary considerable the result often left a lot to be desired. The only alternative for the hard pressed Independent Telephone man was to guess and we all know that telephone guessing is generally an expensive process. As a result transmission trouble in the smaller exchanges generally represented considerable loss of both time and money with the service suffering in general.

The Attenuation Box, Decibel Meter and tone generator being used to test cord circuits on a multiple switchboard.

The decibel meter being used in the field. Mr. Mitchell, engineer for the Shallcross Mfg. Co., on left and Mr. Starkweather, engineer for the Signal Corps, on the right.

(Left) Using the decibel meter at a cable terminal. (The author up the pole as usual.)



(Right) The transmission testing set used to measure the transmission on a common battery subscribers set. The line is connected to the wire chief's test set and the telephone instrument in series with it.

Great progress has been made in the past few years to simplify the accurate measuring of transmission losses on telephone lines and equipment. Not only has test equipment been improved and made easier to use, but they have also been reduced considerably in cost. They are designed to accurately measure the electric current at the usual voice levels and frequencies. In the usual transmission of speech over wires, the power available at the receiving end decreases with the distance it travels. This decrease when plotted follows a logarithmic curve of the distance from the transmitting to the receiving end of the line. This characteristic has practical value and makes possible the adoption of a logarithmic unit of measure the "decibel" (db) to designate transmission losses or gains. This unit may be directly added or substracted which permits easy and accurate calculations to be made in the field. It is also a well known fact that the response to the human ear to fluctuations in acoustic power is likewise logarithmic in character. From this it is clearly indicated that improvements in transmission over a line measured in decibels cause practically the same proportional changes in the perception of volume to the human ear.

BRIEFLY the decibel is a unit of measure for expressing the ratio between the amount of electrical energy transmitted and the amount received at the distant end of any telephone line being considered. This will indicate that if the power placed on a circuit or certain apparatus and the power received at the distant end is measured it will be possible to have a general understanding of the overall efficiency of the circuit. Also if the sending current is maintained at a constant level and the received power measured before and after making a circuit change, the measure of the efficiency of that particular circuit may be established.

We recently enjoyed the pleasure of making numerous tests with one of these modern and inexpensive transmission testing sets and found it to be entirely satisfactory in every way. This particular set consisted of an accurate meter calibrated in decibels, an attenuation box and tone generator. In this article we shall attempt to pass this information along in hopes that it may assist telephone men in their constant struggle to maintain the quality of their lines up to the modern standard of efficiency by locating and eliminating all conditions detrimental to good transmission.

The decibel meter used on this set consists of a sensitive, rectifier type, instrument calibrated from ten decibels through zero to six decibels. This meter is mounted on a high grade bakelite panel, in a sturdy hardwood case with a detachable cover. Metal binding posts are provided for making connections to the line or telephone type jacks may be mounted in the set when it is to be used on plug ending circuits. This unit is small in size and light in weight though sturdy enough for use out on the line as well as in the central office.

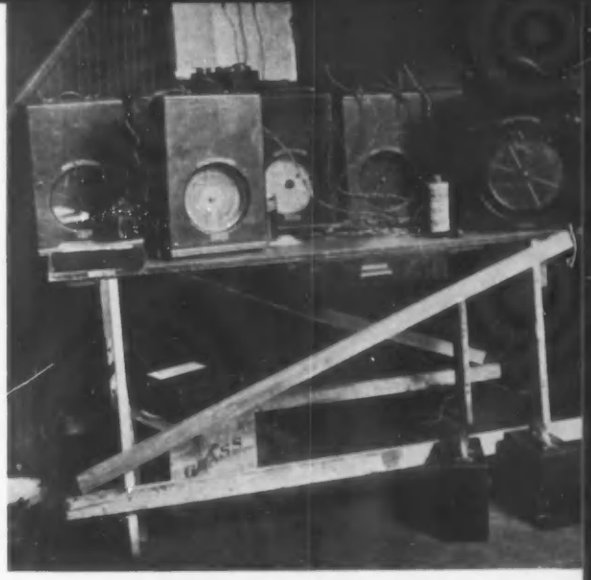
The tone generator consists of a 1000 cycle, constant frequency, vacuum tube oscillator for operating on 110-115-120-volts AC of DC. The output is continuously variable from 5 to 18 decibels and may be further reduced when a suitable attenuation box is connected across the output terminals.

THIS instrument is designed primarily for use on lines or apparatus having a 1000 cycle impedance range from 500 to 600 ohms. When the impedance of lines or equipment is higher than this, the impendance of the tone generator and the decibel meter may be built-up to match the impedance of the line and apparatus to be tested, by adding resistance at each end in an amount necessary to make up the difference between the 1000 cycles impedance and 600 ohms. For tests involving 1000 cycles impedance be-

(Please turn to page 33)

The transmission testing set being used to test cord circuits on a multiple switchboard in a common battery exchange.

CABLE CORROSION



Recording Meter Photo.

"Relation Of Electric Stray Current Corrosion" and Its Prevention to Present Day Problems and "Cathodic Protection"

Corrosion of cable sheaths caused by electric stray currents has in the past clearly demonstrated practical means of making tests and the best analysis. Negative return feeder systems, using either generator boosters or grid resistances have been tried and test results and comparisons have been made. The latest method known as "Cathodic Protection" by forced drainage is a comparative modification of the "Track Return Booster and Grid Systems". Much work may be saved in designing and installing a cathodic protection system, by a careful review of the results obtained in past studies of "Stray Currents Leakage".

FROM the vast amount of literature which has been published on "Electric Railway Track Leakage and Resulting Electrolysis," I am selecting a specific case where I had an opportunity to study Telephone Cable Plant Problems over a period of five years, both before, during and after "Electric Railway Improvement Changes" were carried out. This particular case was selected because I was associated with both individual and joint studies by all of the affected utilities as represented by competent consulting engineers. Combined joint studies were also made under the supervision and co-operation of the United States Bureau of Standards, and these were published in their "Technologic Papers." Many valuable and interesting facts were obtained however in the individual studies made outside of the Bureau investigation. It is the purpose of this article to set forth unpublished data on the complete history of "Telephone Underground Cable Plant," with general data and conclusions from the Tests, Protection Methods used, and their analysis, including the effects of work done by other utilities on the Telephone Plant problems. Opinions are given, not as an indication of infallability, but rather in the hope that the various characteristics, Methods used, and their Analysis, inmay aid in a practical analysis of individual cases found under present conditions and eliminate the need of long and expensive technical study. Naturally as the work progresses, a time may come when competent expert advise will save both time and money in obtaining adequate Corrosion Protection.

A Typical Electric Railway and Corrosion Study. Springfield, Ohio

The various Utility Systems involved were as follows:

Telephone Underground Cable Plant. (From 1911 to 1915 inclusive.)

Gas Pipe Underground local Distribution System.

Gas Pipe Underground high-pressure long distance Transmission Supply Lines.

Water Pipe Underground local Distribution System.

Local Electric Railway track and power Distribution System.

Interurban Electric Railways tracks and Power Distribution Systems.

Note: These involved four companies, separately operated.

History of Telephone Underground Cable System Progressive Study

(a) 1911. Cable system with NO DRAINAGE.

(b) 1911. Cable system with TWO DRAINAGE WIRES.

(c) 1912. Cable system with TWO DRAINAGE WIRES. (One found open underground.)

(d) 1912. Cable system with TWO DRAINAGE WIRES. (Both closed.)

(e) 1913. Cable system with ELECTRIC RAILWAY NEGATIVE BOOSTER OPERATING.

(f) 1913. Cable system with ELEC-ELECTRIC RAILWAY NEGATIVE BOOSTER NOT OPERATING.

(g) 1913. Cable system with BOOSTER CUT-OUT AND RETURNS USED FOR RAIL RETURNS.

(h) Gas and Water Pipe Systems Study. Joint study of utilities with their consulting engineers.

(i) Electric Railways Systems Study. Joints studies of all Utilities with the United States Bureau of Standards.

(k) 1914. Cable system with NO DRAINAGE after Electric Railway Changes were made.

(l) 1914. Cable system with ONE DRAINAGE WIRE TO CITY ELECTRIC LINES only.

(m) 1914. Cable system with ONE DRAINAGE WIRE TO INTERURBAN LINES only.

(n) 1914. Cable system with TWO DRAINAGE WIRES * ONE TO CITY ELECTRIC LINES and ONE TO INTERURBAN ELECTRIC LINES.

(o) 1914. Cable system with THREE DRAINAGE WIRES * ONE TO CITY ELECTRIC LINES AND ONE TO INTERURBAN ELECTRIC LINES and ONE TO A COMMON AREA CONNECTING BOTH LINES.

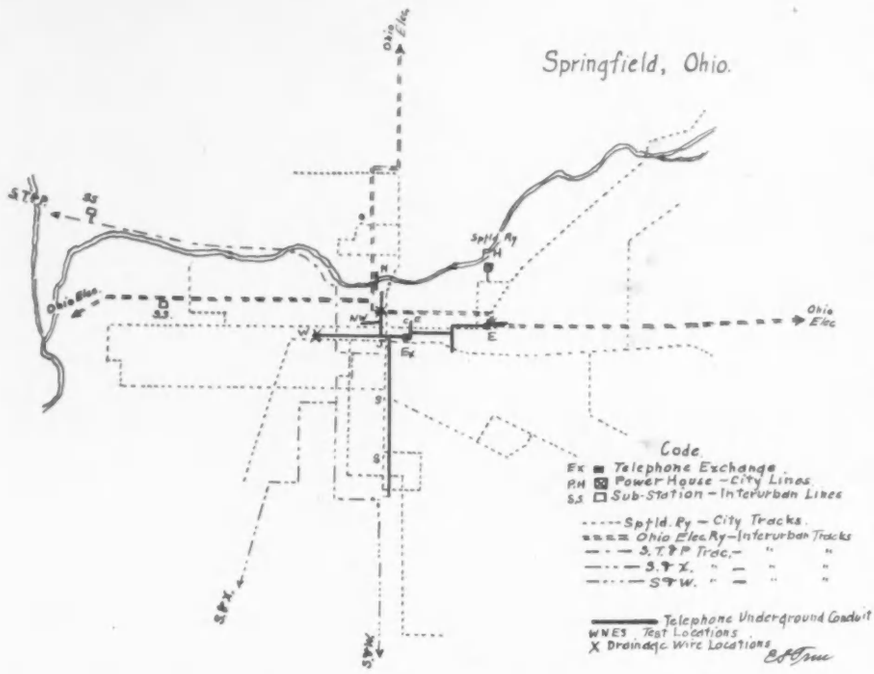


Figure 1—Springfield, Ohio. City map showing telephone underground cable and exchange and all electric lines, tracks and power stations.

THIS map shows the physical layout of the telephone underground conduit system, the exchange, the approximate location of cable-to-earth test control points as indicated by compass letters, and the approximate drainage location points as indicated by crosses.

As data is discussed in the following, several characteristic curves will be shown with each of the periodic surveys as indicated above by the list of lettered items. Only cable-to-earth characteristics will be shown as they form the neuclus basis for all tests and opinions, by considering earth potential as the normal ZERO.

Summary of Data Obtained

Electrolysis tests of the telephone underground cable system were made under varying conditions and at frequent intervals starting with the summer of 1911. At that time no effort had been made by the traction companies to install special means for preventing electrolytic damage to underground structures. In the summer of 1912, agitation was started by the City owned water company, owinging to serious damage they were experiencing. Pressure was brought to bear on the local traction company to oblige them to take some means for reducing such damage.

DATA on the telephone underground cable system was taken both prior to and during each of the changes made toward electrolysis mitigation. In order to determine the effects of such work on cable systems, a thorough study was made by comparing all of the readings taken at various times under different conditions. At the time the last series of tests were made to determine the effects of the Insulated Return Feeder System installed under the direction of the National Bureau of Standards, it was necessary to make a large number of trial tests under each progressive condition, and for this purpose certain key manholes were chosen in different sections of the city as shown on the above map. These represent fairly typical conditions for each section and reduce the amount of work required to compare the results of different arrangements of Drainage Wire Installation.

The manholes chosen represent west, north, east and south ends of the underground cable system, the central point from which all legs radiate, a point near the Ohio Electric passenger station where the heaviest interurban loads center, and a few other points which indicate the growth of the telephone cable during the test periods.

In the summer of 1911, two sets of readings were made: One with practically no drainage altho it was later found that a small poor connection to rail existed at one point carried small currents which however had little effect on the cable system: The second readings were made made after two drainage wires were installed which left the system in practically safe condition.

In the summer of 1912 two sets of readings were again made. The first showed some positive conditions and it was found that one buried drainage wire connection had been broken off. The second set showed conditions after this was replaced.

In 1913 three sets of readings were made, two in January, the first with the NEGATIVE BOOSTER of the city lines in operation, and the second with the NEGATIVE BOOSTER CUT-OUT and its returns used to re-inforce the track returns. The third set was made in September to check the January return system installation effects and also the effects of the telephone underground cable extensions in the north and east ends.

In 1914 tests were made on the telephone cable system after tests on the Electric Railway and Pipe systems were completed as described in the printed reports. Nineteen sets of readings were made, five of which are shown in this article as typical. The first was cable-to-earth with NO DRAINAGE for comparison with original readings in 1913 thus showing the effects of the railway return system on the cable before and after final changes.

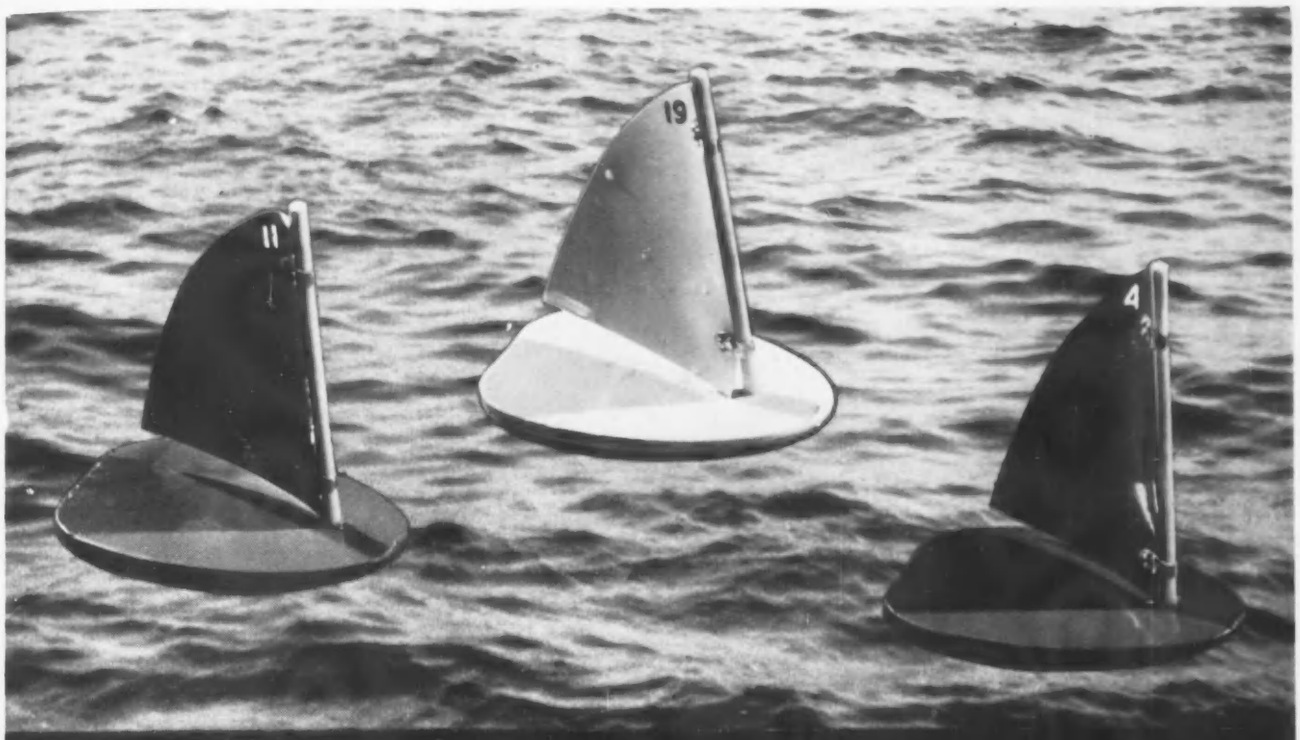
The tests in 1911, 1912, and 1913 were made with standard indicating 100-ohms-per-volt meters and maximum and minimum readings only were made. It is my opinion from many years of tests and analysis over several states, that such readings are generally satisfactory for an economical cable system study where recording meters are not used. Under certain conditions average readings should be made to give a more complete indication of time duration characteristics. All 1914 readings were made with Bristol smoked chart recorders, with five simultaneous charts in nearly every case, representing the west, north, east and south ends of the underground cable and a point near the center of the traction load at the Ohio Electric passenger station.

Recording Meter Tests

The photograph shows the arrangements of centralized test in the telephone exchange.

A city map was mounted on the wall with telephone underground cable runs shown in proper location. Brass terminal screws were placed at the test locations. Cable pairs were assigned at each location and one side connected to cable sheath and the other to a driven ground rod. In the exchange these pairs were extended from the main frame terminals to the map terminals and clearly marked "cable" and "ground." Recorder connections were then made to each location and the simultaneous tests were run.

(Please turn to page 39)



The Hoist Your Sales Contest

A Ready-To-Run Sales Contest, by Zenn Kaufman, Author of "How to Run Better Sales Contests"

The Great Boat Race

The Telephone Yacht Club hereby announces that in March we will hold our first annual free-for-all speed boat race. One boat for each salesman—and the only fuel we use is orders. Put an empty gasoline can on your desk, put a slot in the side, mark it FUEL, and tell the men to "mail all orders here."

Make this a trans-Atlantic race—with ship-to-shore telephone service to keep everybody posted on scores. Maintain a fast patter of ship-to-shore pep bulletins to keep everyone informed on the progress of the race. If a couple of the boys slow down, picture them as drifting along 'quietly with a checkboard spread out between their boats. "HO-Hum" is their theme song. And when the leaders zip along in fine fashion, borrow a cablegram form from your local Western Union office and send an imaginary cable from the captain of the Normandie. He reports, "Joe Dokes just skimmed along at a terrific speed." Let your local Western Union office deliver these messages by hand.

Prizes

At the end of the race, of course, there's a whole mess of prizes, starting with the Commodore's cup. And not forgetting the booby prize. A nice anchor costs just $3.50, and is worth its weight three times over in fun. Ship it to the home of Eddie, the trailing sailor.

Just picture a little two-act play — briefly synopsized as follows:

Act1—Scene: Eddie's home. Time — 10:00 A. M.

Mrs. Eddie: What, a knock on the door? (Goes to the door)

Expressman: Eddie live here?

Mrs. E.: Yes—what's that?

Expressman: An anchor.

Mrs. E.: We didn't order an anchor.

Expressman: Sorry, lady, got to leave it.

Curtain

Act 11—Same place. Time—7 P. M.

Mrs. Eddie: Did you order an anchor

Eddie: No, er - yes.

Curtain

And so it goes. Divide your gang into fleets if you want some team action. Offer a special prize to the three high men on the leading team. Break the contest down into sprints, with special prizes for sprint sales.

FREE Just send us a self-addressed stamped envelope and we'll send you a copy of the SALES CONTEST CHECK LIST— It should guarantee the success of your next contest.

Short Course in Telephone Transmission

By B. C. BURDEN

(CONTINUED)

In order to provide conversion values of sufficiently wide range for practical telephony work. We have shown two tables. *Table No.* 1 covers the range of 1 to 100 db (for voltage and current ratios) and 0.5 to 50.0 db (for power ratios). It will be noted that the voltage and current range is in one decibel steps and the power range in ½ db steps.

TABLE I

Conversion Table for Converting Current, Voltage, or Power Ratios to Decibels.

(1 db Steps for Current or Voltage)
(½ db Steps for Power)

—No. of Decibels—		——Ratios——	
Current or Voltage Decibels	Power Decibels	Gain Ratio	Loss Ratio
1	0.5	1.122	0.891
2	1.0	1.259	0.794
3	1.5	1.413	0.708
4	2.0	1.585	0.631
5	2.5	1.778	0.562
6	3.0	1.995	0.501
7	3.5	2.24	0.447
8	4.0	2.51	0.398
9	4.5	2.82	0.355
10	5.0	3.16	0.316
11	5.5	3.55	0.282
12	6.0	3.98	0.251
13	6.5	4.47	0.224
14	7.0	5.01	0.200
15	7.5	5.62	0.178
16	8.0	6.31	0.158
17	8.5	7.08	0.141
18	9.0	7.94	0.126
19	9.5	8.91	0.112
20	10.0	10.0	0.100
21	10.5	11.2	0.0891
22	11.0	12.6	0.0794
23	11.5	14.1	0.0708
24	12.0	15.8	0.0631
25	12.5	17.8	0.0562
26	13.0	20.0	0.0501
27	13.5	22.4	0.0447
28	14.0	25.1	0.0398
29	14.5	28.2	0.0355
30	15.0	31.6	0.0316
31	15.5	35.5	0.0282
32	16.0	39.8	0.0251
33	16.5	44.7	0.0224
34	17.0	50.1	0.0200
35	17.5	56.2	0.0178
36	18.0	63.1	0.0158
37	18.5	70.8	0.0141
38	19.0	79.4	0.0126
39	19.5	89.1	0.0112
40	20.0	100	0.0100
41	20.5	112	0.00891
42	21.0	126	0.00794
43	21.5	141	0.00708
44	22.0	158	0.00631
45	22.5	178	0.00562
46	23.0	200	0.00501
47	23.5	224	0.00447
48	24.0	251	0.00398
49	24.5	282	0.00355
50	25.0	316	0.00316

—No. of Decibels—		——Ratios——	
Current or Voltage Decibels	Power Decibels	Gain Ratio	Loss Ratio
51	25.5	355	0.00282
52	26.0	398	0.00251
53	26.5	447	0.00224
54	27.0	501	0.00200
55	27.5	562	0.00178
56	28.0	631	0.00158
57	28.5	708	0.00141
58	29.0	794	0.00126
59	29.5	891	0.00112
60	30.0	1000	0.00100
61	30.5	1120	0.000891
62	31.0	1260	0.000794
63	31.5	1410	0.000708
64	32.0	1580	0.000631
65	32.5	1780	0.000562
66	33.0	2000	0.000501
67	33.5	2240	0.000447
68	34.0	2510	0.000398
69	34.5	2820	0.000355
70	35.0	3160	0.000316
71	35.5	3550	0.000282
72	36.0	3980	0.000251
73	36.5	4470	0.000224
74	37.0	5010	0.000200
75	37.5	5620	0.000178
76	38.0	6310	0.000158
77	38.5	7080	0.000141
78	39.0	7940	0.000126
79	39.5	8910	0.000112
80	40.0	10000	0.000100
81	40.5	11200	0.0000891
82	41.0	12600	0.0000794
83	41.5	14100	0.0000708
84	42.0	15800	0.0000631
85	42.5	17800	0.0000562
86	43.0	20000	0.0000501
87	43.5	22400	0.0000447
88	44.0	25100	0.0000398
89	44.5	28200	0.0000355
90	45.0	31600	0.0000316
91	45.5	35500	0.0000282
92	46.0	39800	0.0000251
93	46.5	44700	0.0000224
94	47.0	50100	0.0000200
95	47.5	56200	0.0000178
96	48.0	63100	0.0000158
97	48.5	70800	0.0000141
98	49.0	79400	0.0000126
99	49.5	89100	0.0000112
100	50.0	100000	0.0000100

TABLE II

Conversion Table for Converting Current, Voltage, or Power Ratios to Decibels.

(0.1 db Steps for current or voltage)
(.05 db steps for power)

—No. of decibels—		—Ratios—	
Current or Voltage decibels	Power decibels	Gain Ratio	Loss Ratio
0.1	.05	1.012	0.989
0.2	.1	1.023	0.977
0.3	.15	1.035	0.966
0.4	.2	1.047	0.955
0.5	.25	1.059	0.944
0.6	.3	1.072	0.933
0.7	.35	1.084	0.923
0.8	.4	1.096	0.912
0.9	.45	1.109	0.902
1.0	.5	1.122	0.891
1.1	.55	1.135	0.881
1.2	.6	1.148	0.871
1.3	.65	1.162	0.861
1.4	.7	1.175	0.851
1.5	.75	1.188	0.841
1.6	.8	1.202	0.832
1.7	.85	1.216	0.822
1.8	.9	1.230	0.813
1.9	.95	1.245	0.804
2.0	1.0	1.259	0.794
2.1	1.05	1.274	0.785
2.2	1.1	1.288	0.776
2.3	1.15	1.303	0.767
2.4	1.2	1.318	0.759
2.5	1.25	1.334	0.750
2.6	1.3	1.349	0.741
2.7	1.35	1.365	0.733
2.8	1.4	1.380	0.724
2.9	1.45	1.396	0.716
3.0	1.5	1.413	0.708
3.1	1.55	1.429	0.700
3.2	1.6	1.445	0.692
3.3	1.65	1.462	0.684
3.4	1.7	1.479	0.676
3.5	1.75	1.496	0.668
3.6	1.8	1.514	0.661
3.7	1.85	1.531	0.653
3.8	1.9	1.549	0.645
3.9	1.95	1.567	0.638
4.0	2.0	1.585	0.631
4.1	2.05	1.603	0.624
4.2	2.1	1.622	0.617
4.3	2.15	1.641	0.610
4.4	2.2	1.660	0.603
4.5	2.25	1.679	0.596
4.6	2.3	1.698	0.589
4.7	2.35	1.718	0.582
4.8	2.4	1.738	0.575
4.9	2.45	1.758	0.569
5.0	2.5	1.778	0.562

—No. of Decibels—		—Ratios—	
Current or Voltage Decibels	Power Decibels	Gain Ratio	Ratio Loss
5.1	2.55	1.799	0.556
5.2	2.6	1.820	0.550
5.3	2.65	1.841	0.543
5.4	2.7	1.862	0.537
5.5	2.75	1.884	0.531
5.6	2.8	1.906	0.525
5.7	2.85	1.928	0.519
5.8	2.9	1.950	0.513
5.9	2.95	1.972	0.507
6.0	3.0	1.995	0.501
6.1	3.05	2.018	0.495
6.2	3.1	2.04	0.490
6.3	3.15	2.06	0.484
6.4	3.2	2.09	0.479
6.5	3.25	2.11	0.473
6.6	3.3	2.14	0.468
6.7	3.35	2.16	0.462
6.8	3.4	2.19	0.457
6.9	3.45	2.21	0.452
7.0	3.5	2.24	0.447
7.1	3.55	2.26	0.442
7.2	3.6	2.29	0.437
7.3	3.65	2.32	0.432
7.4	3.7	2.34	0.427
7.5	3.75	2.37	0.422
7.6	3.8	2.40	0.417
7.7	3.85	2.42	0.412
7.8	3.9	2.45	0.407
7.9	3.95	2.48	0.403
8.0	4.0	2.51	0.398
8.1	4.05	2.54	0.394
8.2	4.1	2.57	0.389
8.3	4.15	2.60	0.385
8.4	4.2	2.63	0.380
8.5	4.25	2.66	0.376
8.6	4.3	2.69	0.372
8.7	4.35	2.72	0.367
8.8	4.4	2.75	0.363
8.9	4.45	2.79	0.359
9.0	4.5	2.82	0.355
9.1	4.55	2.85	0.351
9.2	4.6	2.88	0.347
9.3	4.65	2.91	0.343
9.4	4.7	2.95	0.339
9.5	4.75	2.98	0.335
9.6	4.8	3.02	0.331
9.7	4.85	3.05	0.327
9.8	4.9	3.09	0.324
9.9	4.95	3.13	0.320
10.0	5.0	3.16	0.316

Table No. 2 covers a voltage and current range of 0.1 to 10 db in steps of 0.1 db. and the power range runs from .05 to 5.0 in steps of .05 decibels.

For most transmission computations table No. 1 is suitable. When greater accuracy is desired and the exact values can not be found in table No. 1 then table No. 2 should be used. By combining readings taken from both tables the larger range of table No. 1 can be made to have the same smaller steps of table No. 2.

Use of the Tables

In using the tables we either have power, voltage, or current ratios that we wish to convert to decibels or we know the number of decibels and desire to get the corresponding power, voltage, or current ratio. The use of these tables is best illustrated by several specific examples; viz:

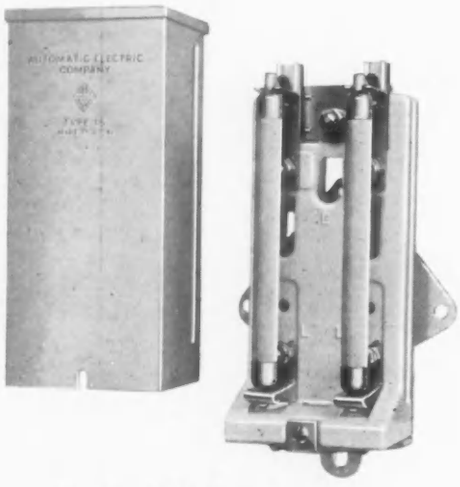
Example No. 1—Assume that the loss on a toll line between two towns is 6.0 db what is the *reduction* in power that takes place over the line? Referring to table No. 1 we locate 6 db in the second column labeled "power ratios." Inasmuch as we are dealing with a loss we will find the power ratio corresponding to 6.0 db in the fourth column under "loss ratio." The figure shown is 0.251, hence we see that our power is reduced to 25.1% of its input due to line losses. In other words, if we have an input power of 1.0 watt our output power will be only 0.251 watts. This relationship on a 6 db line is shown in Fig. 13.

Example No. 2—A measurement of the input voltage to a toll line shows 1.86

(Please turn to page 36)

A NEW SANDS SUBSTATION PROTECTOR

The Type 15 SANDS Substation Protector, with weatherproof cover in place. Note accessibility of screw holes in mounting base.



The Type 15 Substation Protector, cover removed, equipped with Type 2105 Discharge Blocks and slip-type wood fuses.

TYPE 15 SUBSTATION PROTECTORS

Cat. No.	Type of Fuse	Fuse Capacity
SA-81	Fibre, nutted	5 amp.
SA-68	Fibre, nutted	7 amp.
SA-78	Wood, slip-type	5 amp.
SA-79	Wood, slip-type	7 amp.

EASIER TO INSTALL

The new SANDS Type 15 Substation Protector has a specially designed mounting bracket whose corners extend from both sides and bottom, so that mounting screws can be inserted without removing the bracket. Bracket has four screw holes, widely spaced for secure fastening to brick, wood siding or other type of wall.

REQUIRES LESS ATTENTION

This protector is regularly equipped with the famous Type 2105 Discharge Blocks, which automatically ground the line on currents of $1/2$ ampere or more, then automatically reset themselves when the dangerous current has ceased to flow. This eliminates continual inspection, resetting and replacement expense.

PERMITS STANDARDIZATION

The Type 15 Protector is equipped with a weatherproof cover and is designed for outdoor use, but its neat, compact construction makes it equally suitable for indoor mounting, and permits standardization on one type of protector for both applications.

USES FIBRE OR WOOD FUSES

A special mounting arrangement for the fuse clips at one end of the protector permits the use of either fibre or wood fuses, as the user may specify, by merely providing the proper type of fuse clips in each case. Write for prices and full information on this and other SANDS protection products.

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MAKERS OF TELEPHONE SIGNALING AND COMMUNICATION APPARATUS
ELECTRICAL ENGINEERS, DESIGNERS AND CONSULTANTS

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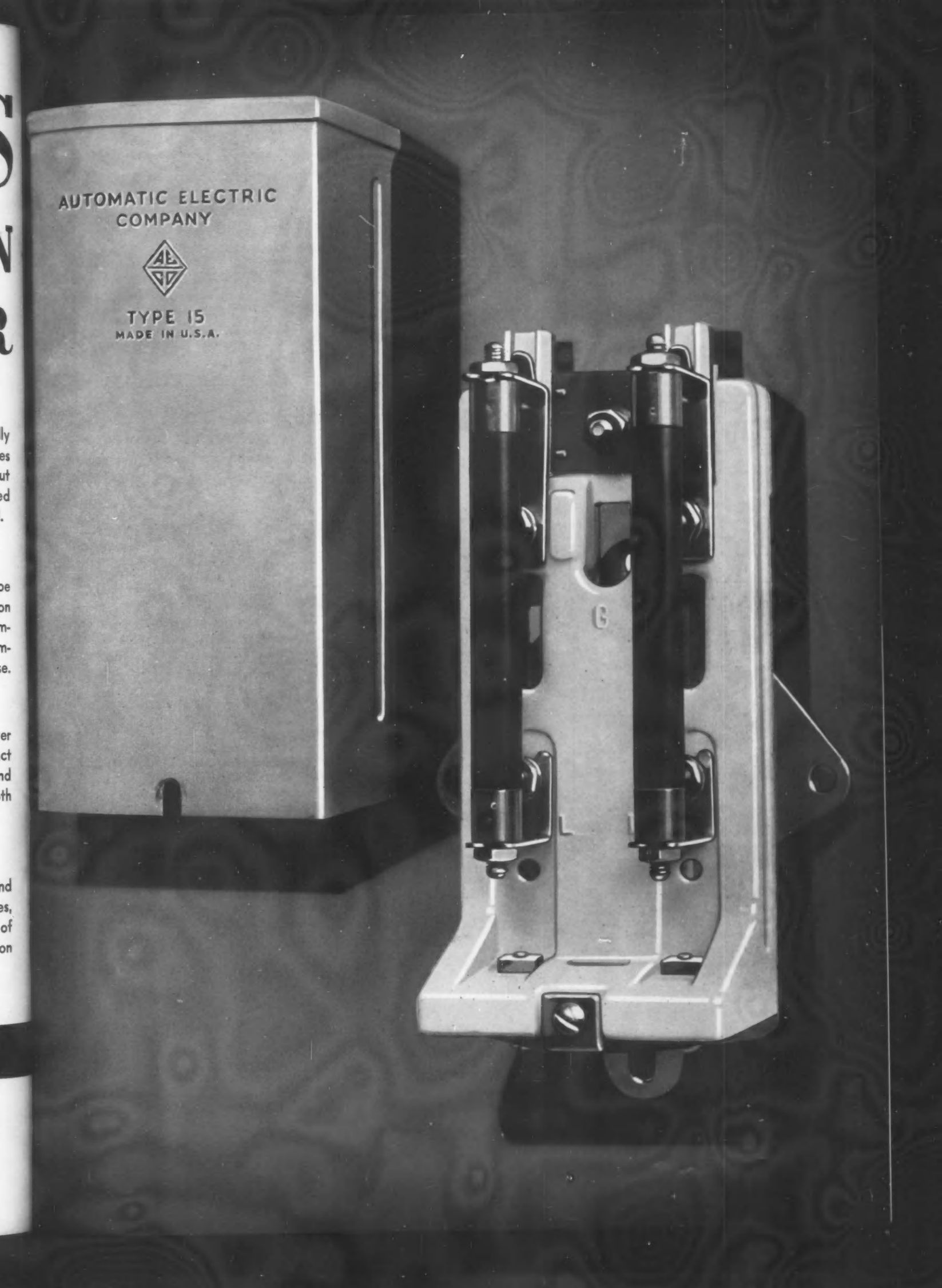

AUTOMATIC ELECTRIC
COMPANY
TYPE 15
MADE IN U.S.A.

"Tapping In" on Washington

(Continued from page 16)

studying the problem and the status of the question up to the present time so that Senators and Congressmen would be fully advised about its various phases. Administrator Andrews in his statement declared that his agency had not had sufficient information to express a "well-founded opinion" on the merits of the proposed amendments to exclude exchanges of 1,000 or less subscribers. He also claimed that the Wages-Hours Division had received many letters from telephone employees complaining about wages and hours of work in certain parts of the industry.

The U. S. Independent Telephone Association immediately after the issuance of Mr. Andrews' statement offered its assistance to supply the Administrator with any further information about the Independent industry which he desired in addition to the tremendous amount of data already furnished. The Association also asked for the right of investigating any complaints of employees about wages and hours of work and for permission to remedy any improper conditions. *The Wages-Hours Division accepted the offer of the Association to supply further data about the industry and the latter organization at once commenced the gathering and transmission of the additional information.*

Commissions Advise Wage-Hour Administrator

On February 14, Mr. Carrol R. Daugherty, Chief Economist of the Wage-Hour Administration at Washington, sent a telegram to all State Utility Commissions having jurisdiction over telephone rates, inquiring what the opinion of the Commission was as to the exclusion of the telephone industry from the Wage-Hour Act; and as to whether the industry should be excluded on a basis of number of telephones, size of the town, exchange revenue, or some combination of the three items.

We are advised that so far 35 of the 45 State Utility Commissions have answered. 25 of them put the figure at from 1000 to 1200 subscribers, and in several cases this was limited to urban subscribers. Wisconsin, for instance, recommended that 1000 urban subscribers or less should be exempted from the Act, and defined urban subscribers as those paying urban (or city) rates. 1 put the figure at 750; 5 were on the 500 mark; 1 recommended 5 operators or less; 1 complained that it was without jurisdiction in interstate matters; 1 recommended communities of 5000 population or less; and 1 suggested $7500 gross annual revenues or less. Up to date 10 have not answered.

FCC Regulation of Rochester, N. Y. Telephone Corporation Before Supreme Court

Before the nation's highest judicial tribunal, the U. S. Supreme Court, the question of whether or not the Rochester, N. Y., Telephone Corporation, one of the largest Independents in the country, is subject to the full provisions of the Communications Act was argued during the second week in March. The Supreme Court probably will hand down a decision during April.

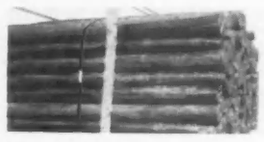
THE FCC has held that the Rochester Corporation, because of a one-third common stock interest and of a substantial preferred stock ownership by the New York Telephone Company, is finacially controlled by the Bell System and therefore is subject to the entire Communications Act. The Rochester Corporation denied any such control because a voting trust of two-thirds of the common stock, which votes on the company's operations, is in the hands of three local Rochester persons under an irrevocable arrangement. A three-judge Federal statutory court in 1937 upheld the FCC's position of its complete jurisdiction over the Rochester Corporation.

T. Carl Nixon, attorney for the Rochester Corporation, told the Supreme Court that his company is actually and legally controlled by the voting trustees and that the New York Telephone Company exercises no such powers over the independent company. James A. Kennedy, FCC Assistant General Counsel, stressed that the New York Telephone Co. through its ownership of 97 per cent of the outstanding common and preferred stock combined has the "power" to control the Rochester Company since the veto power of the Bell System carrier

(Please turn to page 41)

ACME UNIT-LOAD METHOD MAKES POLE UNLOADING SAFER...FASTER MORE ECONOMICAL

Acme Unit-Load Band—used by many leading pole shippers for safe delivery—faster, easier loading and unloading.



View of car braced with Acme Unit-Load Bands.

Showing how safely and easily bands are removed from side opposite unloading side.

Tension is gradually eased and poles roll safely off the car.

Personal injury hazards, previously encountered in unloading poles, are eliminated when Acme Unit-Load Band is used. It gives unloading crews more accurate control over each step of the unloading procedure. Unloading is easier — takes less time — is more economical.

Acme Unit-Load Method is simple and easy to apply. The flat Acme bands are placed around the poles and across the stakes, tensioned and sealed to form a large, secure unit. Unloading is safely and easily accomplished by following the simple procedure suggested in the Acme booklet. Write for your copy today—there is no obligation.

THIS FREE BOOKLET TELLS HOW

ACME STEEL COMPANY
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Send me a copy of the booklet about POLE SHIPMENTS with suggested safe Unloading Procedures.
Name .....
Address .....
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For your benefit,

Western Electric keeps on pioneering!

● Bell Telephone Laboratories and Western Electric never stop looking for the better way. Out of this urge to improve have come such outstanding developments as unit type cable, paper pulp insulation, and scores of improved manufacturing processes that help to give you better telephone cable.

Whatever your cable needs, talk them over with Graybar Electric, Graybar Building, New York.

Western Electric

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LINE and DESK

RAY BLAIN, Member A. I. E. E., Editor

Q. We are in need of a moving platform of some kind to use in the repair of aerial cable. Can you suggest something which will not prove overly expensive?

A. We have used an extension ladder lashed to a construction truck, in an upright position. This will prove satisfactory when a good strong ladder is used. Some telephone companies use a platform with a rail around it suspended from the top of a pole derrick on a construction truck. This arrangement proves satisfactory but is rather difficult to move and spot properly under the cable. Special trucks are now available with an adjustable platform and ladder which prove an ideal arrangement on work such as aerial cable repairs.

Q. We are in need of a special gear arrangement of some type to apply power to an ordinary hand operated winch for cable pulling. We would like to make use of an electric motor for this purpose. Can you suggest anything which might be used for this arrangement?

A. There is now available for this purpose a portable worm gear power drive, which is operated by any standard make electric drill of ½", 5/8" or ¾" size. This gear is built for heavy duty use on any job where rotating motion is desired. The power developed is equal to the turning strength of 3 or 4 men. The speed is faster than men can ordinarily turn a crank. The machine is portable and may be carried and operated by one man with complete safety and ease.

Q. We are planning the purchase of some all-metal operators chairs and would be pleased to know whether there are any special rules which should be observed in the calculation of our chair requirements?

A. We have learned that it is always best to select a chair in which the minimum seat height is as close as possible to the average height at which you intend to use it. The reason for this is that the closer you keep to the base, the less strain will be placed on the spindle and bearings and the longer they will last. When a chair is used at its maximum height day in and day out the side pressure on the bearings will cause faster wear on the moving parts. When all-metal chairs are properly selected they will give long and faithful service at a most reasonable annual cost.

Q. We plan the purchase of a portable gas engine generator for the operation of our numerous portable electric tools out on the job. What size outfit would you recommend for this purpose?

A. To make sure that you have adequate capacity for all tools and to operate two or more of them at one time when you desire, we suggest a generator with an output of about 2000 watts. This machine costs little more than a smaller size and will weigh only about 155 pounds.

Q. Why is a pole derrick necessary on a modern line construction truck when the pole derrick and winch can be used for pole pulling?

A. Many desire to make use of a jack and winch is used to pull them. It is to start poles even when the derrick also useful in pulling extra large poles which might injure the derrick on a straight pull. A pole jack is almost a necessity on any well equipped line construction truck as it can always be used frequently and to advantage.

Q. Can you tell us why cone anchors are not more generally used and are they generally considered satisfactory for all ordinary pole line anchoring?

A. Cone anchors are used extensively for some types of lines in certain soil conditions. Rock is usually considered necessary in setting this type anchor and in some localities this may prove quite a problem. We suggest that you consult the manufacturers as to the best type anchor to use in your certain locality for the type of line you intend to anchor.

Q. On large wire stringing jobs when ten wires are strung at one time and the reels are double decked how may transpositions be thrown in the wire?

A. Ordinarily each wire is equipped with a snap which in turn is attached to a ring on a running board. These snaps can then be changed with ease to throw transpositions. Special metal running boards may also be obtained in which each pair of wires are attached to a swivel arrangement which may be turned and locked in position to throw a transposition in the wires being strung.

Q. Would it be possible to mount telephone relays so that they could be slipped into a socket like a vacuum tube? This would make replacement easy and quick in event of trouble.

A. This arrangement has been used to some extent on special equipment but we would not consider it necessary on ordinary telephone equipment. Telephone relays are all so well made these days that they cause little trouble. Also ordinary relay trouble may be easily cleared without replacing the relay. The special jack mounting adds considerable to the cost and would probably not prove economical except in a few cases on some special equipment.

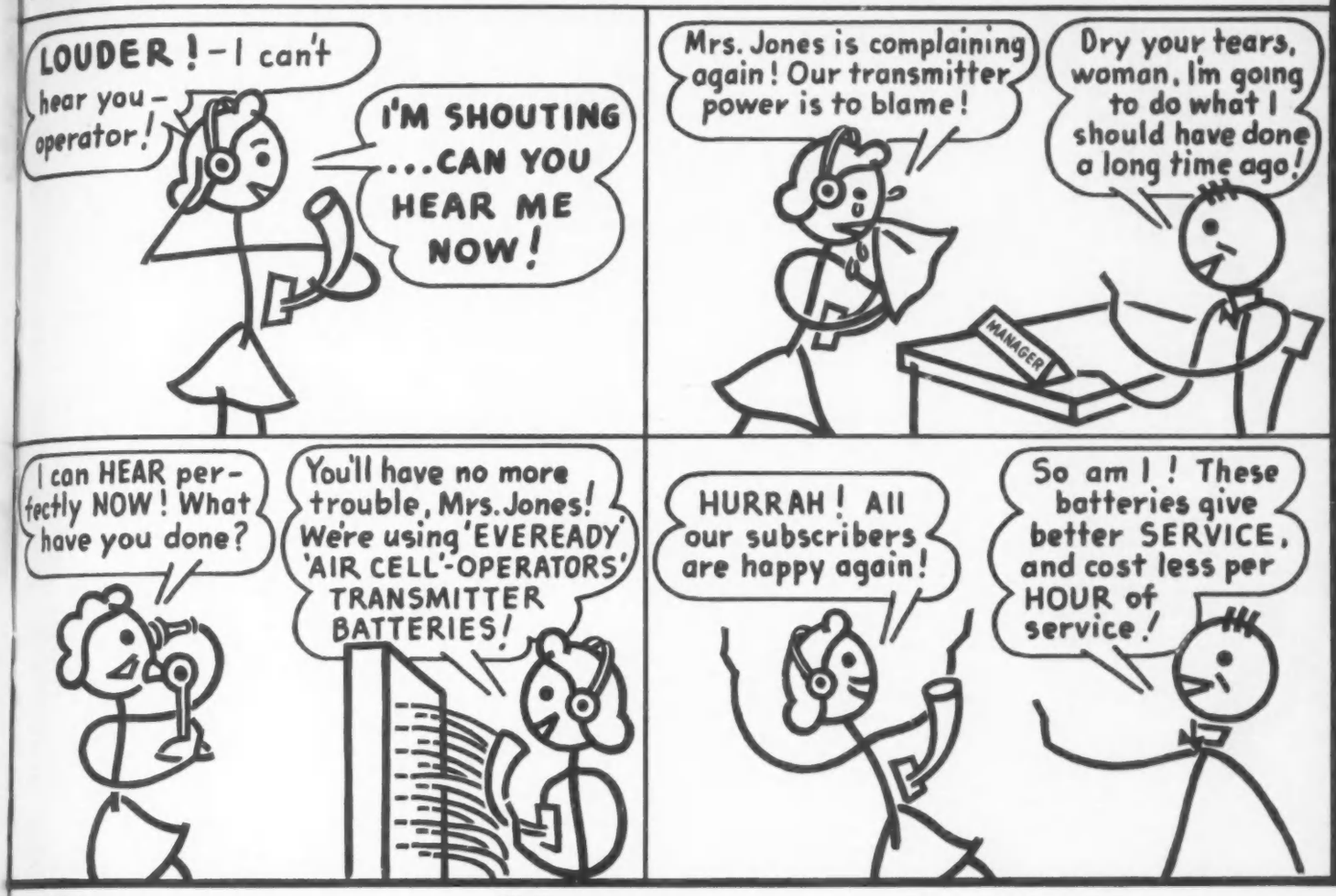
Q. We are being bothered considerable by moisture in our exchange at certain periods of the year. This moisture attacks the equipment causing leakage, poor transmission and shortens the life of the equipment in general. Is there any method whereby this may be prevented without the expense of complete air conditioning which we cannot afford at this time?

A. Equipment may be obtained at a reasonable cost which removes moisture from the air by means of a chemical which is a compound of calcium chloride. This is an inert inexpensive chemical and activated carbon which absorbs water from the air. The equipment is arranged so that 1.25 pounds of the chemical will absorb one pound of water. The moisture content is automatically controlled by a humidistat which may be set to control any desired relative humidity.

Address Questions to Line & Desk Editor

Ray Blain

TRUE TELEPHONE TALES... *From Tears to Cheers!*


LOUDER! – I can't hear you – operator!
I'M SHOUTING ...CAN YOU HEAR ME NOW!
Mrs. Jones is complaining again! Our transmitter power is to blame!
Dry your tears, woman, I'm going to do what I should have done a long time ago!
MANAGER
I can HEAR perfectly NOW! What have you done?
You'll have no more trouble, Mrs. Jones! We're using 'EVEREADY' 'AIR CELL'-OPERATORS' TRANSMITTER BATTERIES!
HURRAH! All our subscribers are happy again!
So am I! These batteries give better SERVICE, and cost less per HOUR of service!

NATIONAL CARBON COMPANY, INC.

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that the "Eveready" "Air Cell" Telephone Operators' Transmitter Batteries, Nos. T-600 and T-300—when used in the telephone service for which they are designed and in connection with transmitters of modern design, and when properly installed and maintained according to directions provided therewith —will deliver a minimum of 6,000 hours of peak transmission efficiency.

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You Should Use
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- ★ SUSTAINED VOLTAGE
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- ★ 6,000 TALKING HOURS GUARANTEED
- ★ EASY TO HANDLE
- ★ YOU CAN GET THEM QUICK!

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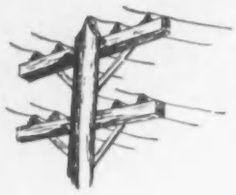
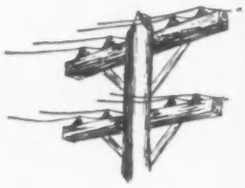


LONG LINES



R. A. Clark, Jr.

Carrier Frequency Attenuation

CABLE, in so far as carrier telephone and telegraph operation is concerned is a necessary evil. It is practically impossible to avoid sections of cable in open wire lines especially in the vicinity of cities. Cable sections 1,000 feet or less in length are not of serious consequence and in general require no special treatment. Longer lengths should be studied to determine the best method of reducing the attenuation and other deleterious effects caused by mismatch. In the previous article we learned that the average open wire circuit had an impedance of approximately 650 ohms. The impedance of nonloaded cable at carrier frequencies ranges between about 200 and 125 ohms depending on the size of the cable and the frequency at which the measurement is made. Nineteen gage cable ranges from about 200 to 150 ohms. Thirteen gage cable ranges from about 150 to 125 ohms. The characteristics of nonloaded phantom cable circuits is about 15% less than the impedance of the side circuit. The impedance characteristics of rubber insulated cable circuits is of the same order as the paper insulated cables described above ranging from 10% to 25% less depending on the size of conductor and characteristics of the rubber compound.

There are two ways in which the impedance of the cable can be adjusted to that of the open wire. The first consists of the installation of loading coils at intervals of 800 to 1500 feet depending on the cut-off frequency required.

The second method consists of the installation of impedance matching transformers at the junction of the cable and open wire. Carrier frequency loading is rather expensive except where only one or two loading points are required. It is often possible on lengths of cable up to about 1500 feet to connect the loading coils at the cable terminals only; in such cases the cost is relatively low. Where only one or two circuits are to be loaded the loading coils can be inserted in the cable splice. This eliminates the necessity of potting the coils and results in considerable savings.

WHERE the cable section exceeds about 2000 feet it is generally more practical to install matching transformers at the junction of the cable and open wire. Fig. 1 shows the connections commonly used. For the best match at carrier frequencies an impedance ratio of 4 to 1 is suitable. Inasmuch as the impedance characteristics of cable increase at the lower frequencies there is considerable mismatch in the voice range. This may introduce sufficient irregularity to interfere with the successful operation of voice repeaters. In such cases a compromise can be effected by the use of a matching transformer having an impedance ratio of 2 to 1. This will increase the loss at carrier frequencies somewhat (1 to 3 db) but will materially improve the balance at voice frequencies.

The carrier frequency attenuation of nonloaded cable when connected to open wire lines through proper matching transformers is shown in Fig. 2. The matching transformers introduce a loss of approximately 1 db which should be added to the cable losses determined from the curves. The installation of loading will reduce the loss shown in the curves by approximately 50%.

● Occasionally it is necessary to use voice

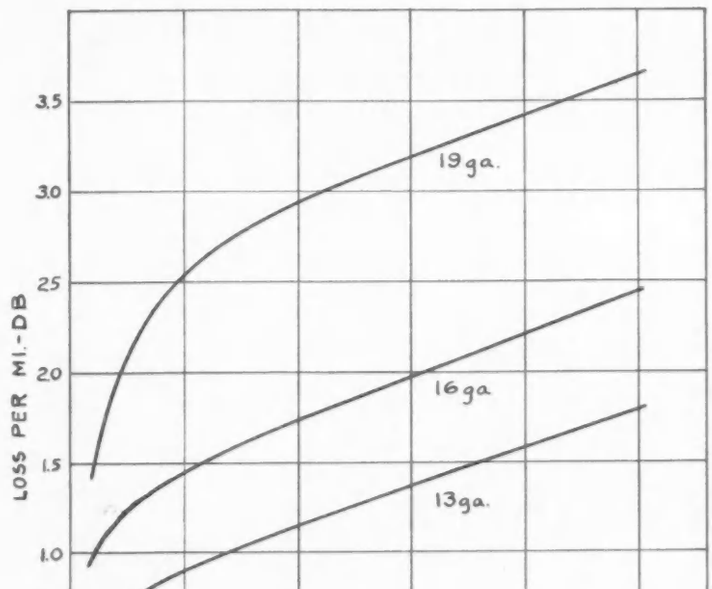


Fig. 2—Transmission Characteristics of Non-Loaded Paper Cable

SIMPLIFIED KEY-BOARD PROMOTES *Speed and Accuracy* WITH THE STROMBERG-CARLSON SUPER-SERVICE SWITCHBOARD!

Typical Super-Service Keyboard. Finger points to one of the party-line ringing buttons common to each position.

Testing and power equipment mounted on relay frame in the terminal room. Relays associated with the power control panel provide for the automatic switching to emergency equipment in case of regular power supply failure.

Converters: Both vibrators and transformers for these switchboards are furnished in duplicate. Apparatus is mounted on a steel frame. This machine converts battery current into necessary frequencies for party line, toll line and rural line ringing.

CREATING satisfied customers is a question of constant importance to the operating company. Two things that are important factors of subscriber satisfaction are *fast service* and *accurate service.*

These two features are invariably found when operating companies use Stromberg-Carlson Super-Service Switchboards. This is due to the simplified keyboard construction used on these switchboards. Instead of the confusing, bristling array of party line push buttons before each operator's position, there is but one push button for each position for each ringing frequency. Consequently, the operator can work much faster and far more accurately. This feature is also important from the standpoint of reducing maintenance costs as it eliminates from two to three hundred parts.

Write for illustrated Bulletin describing the *21 Operating Features* which promote speed and accuracy in Stromberg-Carlson Super-Service Switchboards for exchanges of 600 to 10,000 lines.

Stromberg-Carlson Super-Service Switchboard used in 600 line exchange.

Relay Gates: All relays, condensers and miscellaneous coils for cord circuits, and operator's equipment are readily accessible, mounted on horizontally swinging relay gates in the rear of each operator's position.

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frequency loaded cable in order to maintain proper transmission and impedance characteristics at voice frequencies. Such cables will not pass the carrier frequencies and it is necessary to use two cable pairs, one loaded for the voice frequency the other nonloaded and connected to the open wire line through high pass filters. These filters can be made weatherproof and mounted either in the cable terminal or on the pole. The high pass filter can be designed with an appropriate matching circuit so that the loss is no greater then with the standard matching transformer.

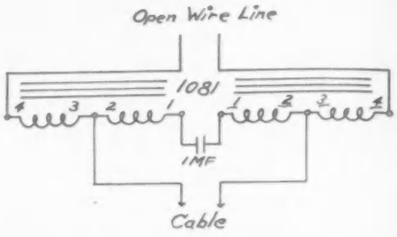


Fig. 1—Matching Transformer

Correction for 'Long Lines' February

(Explained in box at right)

The impedance characteristics of open wire lines at carrier frequencise ranges from about 600 to 700 ohms. Most carrier apparatus is designed for an impedance of about 650 ohms which is sufficiently close to the characteristics of open wire circuits commonly used that no matching equipment is needed. Even in the case of iron circuits where the impedance is appreciably higher (ranging from about 800 to 1500 ohms) matching transformers are of little value. The impedance does not change appreciably with weather.

Chicago, Illinois

Telephone Engineer,
185 N. Wabash Avenue,
Chicago, Illinois

Gentlemen:

Referring to Mr. R. A. Clark Jr's article on Carrier Frequency Attenuation in the February edition, there seems to be a deletion of a part at the end of page 32 and the continuation on page 33. I trust that the deleted part be given in the next issue.

Will you not also have Mr. Clark elucidate a little further on the statement—last paragraph on page 32—"The impedance characteristics of open wire lines at carrier frequencies ranges from 600 to 700 ohm." What length of wire circuit is required for this ohmage. Apparently the ohmage has some reference to length of circuit. Also does not the wire diameter have some bearing on the ohmage.

Referring to Mr. B. C. Burden's Series of Articles entitled "Short Course on Telephone Transmission," this subject is being very clearly presented. When the series is completed, could it not be reprinted in pamphlet form for ready reference and offered for sale at a popular price.

Yours truly,
A Subscriber

Editors Note: The paragraph in question is reproduced in full. To our printer: Tsk, Tsk! for omission.

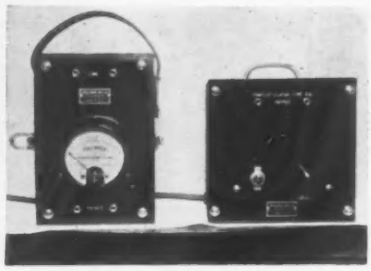
Bell Station Gain In February

More telephones are in the service of Bell System throughout the country than ever before, figures announced by the American Telephone and Telegraph company disclosed March 2.

A net gain of 68,300 installations during February was reported. This brought the total at the end of the month to 15,894,900. The increase was 29,900 in February, 1938. The figures include only those of operating companies in the Bell System.

TRANSMISSION TESTS MADE EASY

The Shallcross No. 690 Transtester (Decibel Meter) and No. 691 Tone Generator (1000 Cycle Oscillator) were developed to provide a convenient yet inexpensive method of measuring transmission losses in lines, switchboard circuits, apparatus and other equipment.



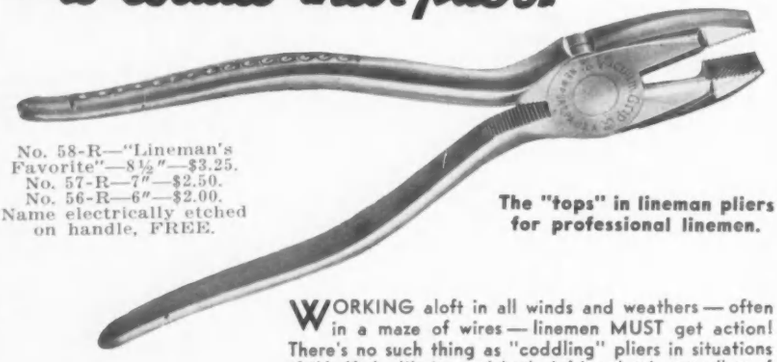
(No. 690) (No. 691)

This testing equipment gives the wire chief a convenient method for making tests of the switchboard and main frame, testing cord circuits, picking up cable pairs and checking subscriber lines.

Write for Bulletin No. 690NH

Shallcross Mfg. Company
Collingdale, Penna.

You can't get linemen to "coddle" their pliers



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BUILT UP TO A STANDARD
NOT DOWN TO A PRICE

TELEPHONE TRANSMISSION TESTING

(Continued from page 18)

low 600 ohms an impedance matching-transformer is required at each end of the circuit under test. However, for all ordinary testing in the average telephone exchange the instruments as furnished will be found entirely satisfactory without change or modification.

The tone generator is inclosed in a black metal case with a convenient handle for carrying. It is furnished complete with tubes and a six foot, heavy duty cord for connecting to the power supply. The output terminals are metal binding posts though space is provided for mounting telephone type jacks when desired. Additional binding posts are provided for audible monitering by means of a telephone receiver.

The attenuation box provides a total of 30 decibels which may be inserted in steps of five decibels by means of three lever type keys. The input and output impedances are equal, since the device is an "H" pad and the characteristic impedance is 600 ohms. This attenuation box may be connected between the tone generator and the decibel meter to provide standard values of attenuation. As an example, if it is desired to set the output of the tone generator at 15 decibels the 15 decibel key of the attenuation box is operated and an adjustment made at the tone generator until the decibel meter registers zero. With this arrangement the tone generator must deliver exactly 15 decibels which is absorbed in the attenuator, leaving zero decibels at the meter. The attenuator box may be set at zero (All keys normal) and the tone generator, with setting unchanged, can then be used as a tone source of 15 decibels at 1000 cycles. The attenuator and extra "H" pads may be used when necessary to increase the range of the transmission set when measuring extra long lines.

The transmission test set has a wide field of uses in any telephone exchange, be it magneto, manual or automatic. Perhaps the most common used test is the one when the tone generator is connected to a line in the office, either at the main frame or switchboard. The decibel meter is then connected across the tone and adjusted until a zero reading is obtained. The meter is then removed and connected at the distant end of the line and the reading obtained will indicate the transmission loss over the total distance. With this arrangement any abnormal loss on the line may be instantly detected. This test will also prove quite useful on a toll or rural line to detect any abnormal

Mr. Starkweather, engineer for the Signal Corps, using the decibel meter to test a line. The tone generator is connected to the line in the office.

conditions which ordinarily cause transmissions losses. The tone generator can be connected at the office and the meter connected at intervals of one mile along the line and the readings noted. Any appreciable loss greater than the calculated normal loss of a mile of the type wire used will indicate trouble on that section of the line which may then be located and cleared.

ANOTHER method is to connect to the tone generator across a line at the central office after it has been ordered up on the wire chief's test set and the decibel meter connected in series with the line. The tester can then note the meter reading while the troubleman talks into the transmitter at the subscribers stations. In this manner any abnormal condition on either the line or the telephone may be instantly detected.

Various useful tests can also be made on transmitters, receivers, condensers, induction coils, repeating coils and other parts of telephone apparatus to detect conditions which would cause excessive transmission losses if an attempt was made to use them in working telephone circuits. Two methods are commonly used for this purpose; the series and the parallel method. For the series test a jumper is run direct from one terminal of the tone generator to one terminal of the decibel meter. A second jumper is

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connected from the other terminal to the tone of the apparatus under test, and a third jumper from it to the remaining terminal of the decibel meter. With this arrangement the apparatus under test is conected in series circuit between the tone generator and the meter. The losses will be easily detected and comparisons between different pieces of apparatus can be quickly made.

With the parallel method two short jumpers are used to connect the tone generator direct to the decibel meter. The equipment to be tested is then simply connected in parallel across the jumpers and the loss indicated. Equipment can also be easily compared with this method. Condensers are compared on either test and a special hook-up can be used to test the balance of repeating coils.

This testing equipment may also be used to advantage in the measuring of crosstalk on parallel lines. The tone generator is connected to one line and the decibel meter to the other running parallel to it. A 600 ohm short-circuit is then connected across the distant ends of both lines and the reading on the decibel meter noted. When the meter readings does not appear satisfactory a receiver may be connected across the second line at the meter and the strength of the tone noted.

The tone generator may be connected at the wire chief's test set or main frame and linemen can use their handsets to locate cable pairs by its aid, quickly and accurately. The tone proves most useful on all cable splicing jobs. The tone can also be used to advantage on some trouble jobs to locate cut-outs quickly. The 1000 cycle tone will not cause interference on nearby lines as do some rough tones produced by ordinary buzzers.

THE transmission testing sets may also be easily and conveniently used to test and compare cord circuits on a magneto or common battery switchboard One convenient method is to conect the tone generator on a vacant subscribers line at the main frame and the decibel meter to another. A pair of switchboard cords are then plugged into the two lines and the reading noted. The transmission loss over the circuit may be measured and the various cord circuits compared so that any unusual condition may be easily detected. Or the tone generator and the decibel meter can be equipped with jacks and the cord coreuits plugged into them at the key shelf of the switchboard. Perhaps the latter is the most convenient arrangement and the one generally preferred in the average exchange.

Space here will not permit an explanation of the numerous tests which may be performed with this inexpensive

The tone generator and the decibel meter connected for test at the main frame of a small common battery exchange.

and convenient transmission test set in any telephone exchange. However, no one need have any fear that they will experience the slightest difficulty with its use even though they have not had previous transmission testing experience. Complete instructions are furnished by the manufacturer which explain in detail how the various tests can be made to best advantage. The average telephone man will find this tester as simple to use as a common magneto test set. We feel sure that this equipment will prove a worthwhile investment, of lasting benefit, in any modern telephone exchange and we suggest that you investigate its possibilities.

Denver & Ephrata Company Shows Much Improvement

Figures from C. E. Eaby, vice president and general manager of the Denver & Ephrata (Penn.) Tel. & Tel. Co., just released show substantial additions and improvements during 1938. At the close of the year the company was operating five central offices with a total of 4197 stations, and 19 branch exchanges. Funded debt was reduced and a total of 519 stations were installed during the year.

All officers were re-elected at their annual stockholders meeting. These include: president, W. F. Brossman; Mr. Eaby; treasurer, D. W. Buch; secretary, Monroe Lausch; assistant secretary, and treasurer, Bertha B. Brossman.

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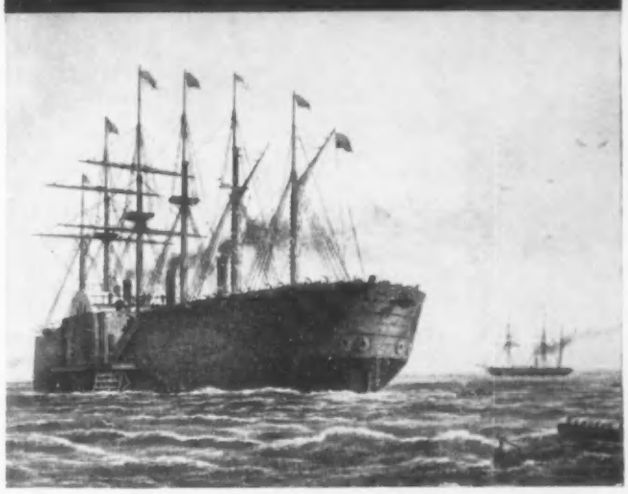

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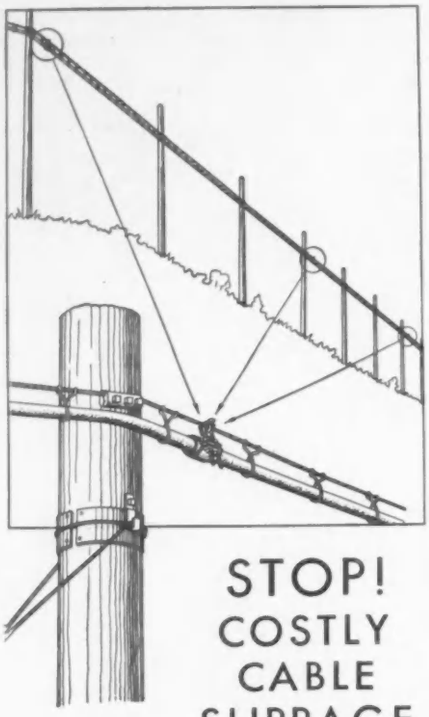

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TELEPHONE ACCESSORIES

SHORT COURSE IN TELEPHONE TRANSMISSION

(Continued from page 23)

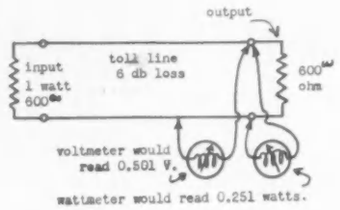

Fig. 13—Voltage and power relationship on a toll line having a loss of 6 db.

volts. What is the loss (attenuation) in decibels on this line? (Note—Assume the same impedance at both ends of the line.) We must first compute our voltage ratio which is $\frac{0.93}{1.86}=0.5$. Referring this value to the table No. 1 we look down column four (loss ratio) until we come to a ratio which is nearest to that which we computed. In this example we find that 0.501 is closest to our value. Opposite this ratio in column No. 1 we find the corresponding number of decibels, viz: 6.0 db. Had we been dealing with current instead of voltage we would have gone through exactly the same procedure. (See Fig. 13.)

Example No. 3—What is the gain in db of a repeater if the input voltage measures 0.5 volts and the output 3.5 volts? The voltage ratio here is $\frac{3.5}{0.5}=7.0$. Referring to table No. 1 we locate in Column No. 3 the ratio closest to 7.0 This is 7.08. In column No. 1 we see that this corresponds to a voltage gain of 17 db. (See Fig. 14.)

Example No. 4—A mile of No. 22 gauge cable offers a loss of 1.71 db. What percentage of the input power reaches the output end in a mile of this cable? In order to read this value more accurately we should use table No. 2. In column No. 2 we locate the number of dbs closest to out given value of 1.71. This is 1.7 db and opposite this value in column 4 we see that the loss ratio is 0.676, hence, we learn that only 67.6% of the input power reaches the end of the cable, i.e., 32.4% is lost in the cable.

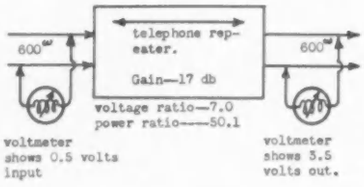

Fig. 14—Voltage relationship in a 17 db repeater.

Extending the Range of a db Table

The range of the decibel tables can be easily extended, by taking advantage of the fact that if we add two separate decibel values together we can determine the corresponding power, voltage, or current ratios *by multiplying* the separate ratios together. To illustrate with simple values, assume we wish to know the power ratio corresponding to 60 db. Our table goes only to 50 db. but we can read the power ratio for 50 and 10 db from our table and then combine them, i.e.

50 db=power ratio of 100,000
10 db=power ratio of 10
50+10=60 db=100,000×10=1,000,000

Suppose we wished to combine a db value taken from table No. 1 with one taken from table No. 2. This could be done in the same way. For example determine the voltage gain ratio corresponding to 22.35 db.

From table No. 1
20 db—power ratio of 100
From table No. 2
2.35 db—power ratio of 1.718
20 +2.35=22.35 db =
100 x 1.718 = 171.8

Decibel Memory Aid

By memorizing the power loss and gain ratios corresponding to the numbers 1, 3, and 10, a person can without aid of a table compute the power ratio for any number of decibels, using the method described in the preceeding paragraph. The three numbers have loss and gain ratios as follows:

db	Loss Ratio	Gain Ratio
1	0.794	1.259
3	0.501	1.995
10	0.100	10.000

Note — for practical purposes consider 3 db as 0.5 or 2.0 (for losses and gains).

From the above we should be able to remember that 3 db means a power loss of 50% or ½, or a gain of 2.0 Whenever we insert 3 db in our line we cut down our power one half, therefore if we

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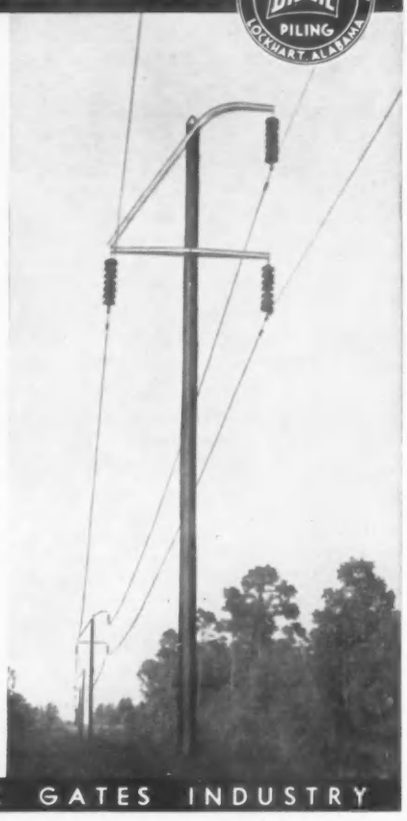

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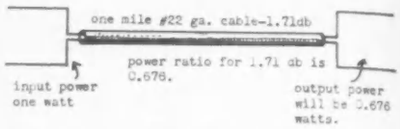

Fig. 15—Power relationship in one mile of 22 gauge cable.

insert 9 db we know that we have cut power in half three times hence have only ⅛ or 12.5% of our original power left. Whenever we add a 10 db loss we reduce our power to 1/10th of its original value. A loss of 1.0 db reduces the power to 79.4% of its initial value.

Now with these facts fixed in mind suppose we wish to know what the power loss for 6 db would be. This would require merely multiplying the two power ratios of 3 db + 3 db together, i.e., $3+3=0.501\times0.501=0.251$. Suppose we wanted to find the power ratio (loss) corresponding to a number such as 17 db. We know the power ratio of 10 db is 0.1 and 1 db is 0.794, and we can find the power ratio of 6 db as explained above by using

$$3 \text{ db} + 3 \text{ db} = 6 \text{ db} = 0.251.$$

The power ratio of 17 db is therefore:

$$17 \text{ db} = 10+3+3+1 =$$
$$.01\times0.501\times0.501\times0.794=.02$$

—TO BE CONTINUED—

N. Carolina Company Starts Improvement

A wide-spread program of improvement and extension of telephone facilities in Yancey, Mitchell, Madison, and Puncombe (N. Car.) counties is scheduled to begin within the next few weeks.

The work will be undertaken by the Carolina Blue Ridge Telephone company of Asheville, N. Car., a newly organized corporation which has just completed the purchase of properties formerly held in these four counties by the Southern Appalachian Telephone company.

Sale of the properties, approved a few days ago by the state utilities commission at Raleigh, involved a consideration of $110,000, it was learned. All stock at present is owned by citizens of Western North Carolina, the commission's order shows.

President of the new telephone company is J. H. Smith, who had served for several years as vice-president and general manager of the now non-existent Southern Appalachian company.

Frederic A. De Peyster Passes On

Frederic Augustus de Peyster, former general traffic manager of the Illinois Bell Telephone company, died Feb. 21, in Cocoa, Fla., where he had gone a month before because of poor health.

Cable Corrosion

(Continued from page 20)

Comparison of Test Data by Progressive Stages

1911.

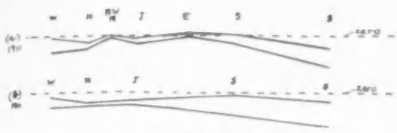

Figure 3—Cable-to-Earth-Curves.

In the two sets of curves shown, the first is with NO DRAINAGE and the second with TWO DRAINAGE wires. Associated cable-to-track readings were made by using another cable pair, but curves for these are not shown in this article.

Condition (a) NO DRAINAGE. These curves show cable-to-earth readings from positive .01 volts to negative 1.1 volts with cable to track from positive .28 volts to negative 3.2 volts. The character of the curves indicated a probable cable-to-track connection near E and an old buried bond was located which carried 6 amperes maximum to rail with a reversal of 1 ampere.

Condition (b) TWO DRAINAGE WIRES. The curves show cable-to-earth readings from negative .07 to 1.2 volts which is an average increase of negative of .1 volts. The combined maximum drainage was 31 amperes or approximately 1% of the total loads of the two power houses in city limits.

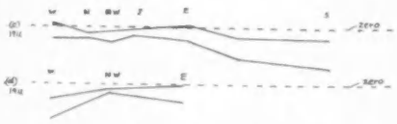

Figure 4—Cable to Earth Curves.

1912.

In the two sets of curves shown, the first is with TWO DRAINAGE WIRES but tests showed one had been accidentally opened. The second curves are with both CLOSED. These readings were taken in the summer of 1912 for comparison with corresponding months of 1911 with practically no changes in cable or traction systems.

Condition (c) TWO DRAINAGE WIRES, one open. These curves show cable-to-earth readings from 0 to 1.4 volts, which is a slight general increase of approximately .1 volt in the area effected by the city railway lines and a corresponding increase of about 10% in the drainage wire current. This compares favorably with the increase in the railway load.

Condition (d) TWO DRAINAGE WIRES.

THE above statement of city railway lines is approximately true for this condition. The curves however as effected by the interurban line sub-station show, in curves (c), two positive areas with the bond open and almost double the negative values of cable-to-earth with the bond closed. At the same time the current in this drainage had increased about 40% in the maximum and also showed a reversal which indicated a poorer condition of track bonding than in 1911 and a physical inspection showed this to be true.

(TO BE CONTINUED)

WANTED:

February 1938 copies of TELEPHONE ENGINEER! Those forwarding this edition will have their subscriptions extended 4 months. Attach your name and address and favor us with your copy immediately.

Scobicia Declivis

C. F. Mason, president of the Associated Telephone Company. Ltd., Santa Monica, Cal., was introduced recently to a very unwelcome visitor. The visitor, known as Scobicia Declivis of Bostrichidae, has quite a reputation as a borer of parts, especially lead cable. The past year he has been quite a constant visitor in Mr. Mason's section of the country giving more trouble in 1938 than in the 5 previous years. According to newspaper reports which gave the story to the public Scobicia Declivis has been biting the cable that feeds it and thereby causing short circuits. We now learn he has terminated his visit. Scobicia Declivis and his brother and sister beetles have been routed.

Railroad Telephone Men to Hold Meeting

The 20th session of the Telegraph & Telephone Section of the Association of American Railroads will meet at the Hotel Jefferson, St. Louis, Mo., on April 18, 19 and 20.

Papers will be presented by L. M. Jones of Western Union, J. A. Parrott of the A. T. & T. and D. A. Fawcett of the New York Central. D. E. Galloway is chairman and W. A. Fairbanks secretary.

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"Tapping In" on Washington

(Continued from page 26)

under certain circumstances places it in complete control of the Rochester Co.'s activities. *The FCC also pursued a line of reasoning which it has advanced in several recent broadcasting court tests that the courts had not the right to review general orders of the Commission which were administrative in character.*

"Hellzapoppin" at FCC—Result, Little Grist Being Ground

VERBAL brickbats and continued feuds among the members of the Communications Commission have slowed up regulatory activities and decisions at that agency except of a routine nature to the minimum of output. The threats of the "ripper" reorganization bills now before Congress and of a Senate or House investigation have caused the FCC to shunt aside many controversial questions with the exception of a number of broadcasting issues in which they have tried to repair the agency's fences to gain Congressional approbation.

The most interesting development in early March was the disclosure that Commissioner E. O. Sykes, the oldest FCC veteran in terms of service, was planning to resign about April 1 from the board to enter private practice of law. Commissioner Sykes, who had been on the old Radio Commission from 1927 to the formation of the FCC in 1934 and who was serving on the FCC under a term due to expire June 30, 1941, formerly headed the Radio Commission and was the first chairman of the FCC in 1934—incidentally the FCC during his chairmanship had the quietest period of its stormy career.

Whether the resignation of Commissioner Sykes will presage other retirements from the FCC had not been disclosed at TELEPHONE ENGINEER'S press time. There were reports in the National Capitol that President Roosevelt might take a personal hand to try to remedy the FCC's difficulties and possibly would call the entire Commission to the White House for a lecture. One other FCC member, Chairman McNinch has indicated at various times that he was desirous of leaving the Commission to return to his former post as head of the Power Commission as soon as possible and it may be that his retirement may be next, although it does not seem likely that he could withdraw in the midst of the Reorganization fight.

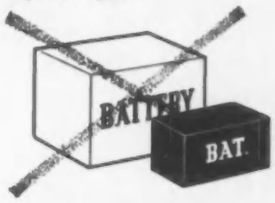
MEANWHILE, the FCC has been working slowly but with some progress on the formulation of its Final Report on the Telephone Investigation. Best indications that the Commission, however, will not be able to transmit the Final Report until late in April or in May because up to the present it has reviewed only the facts of the less controversial chapters in the Proposed Report of Commissioner Paul A. Walker and has ahead of it the most significant portions dealing with Western Electric activities, engineering standards, etc, and in particular the conclusions and recommendations. Upon the conclusion and recommendations of the Walker Report the FCC is almost certain to come to a sharp division and will spend long periods of discussion before an agreement can be reached.

But, in the final analysis, the Final Telephone Investigation Report stands little chance of securing Congressional attention not only at this session but also the next session of Congress—the one just preceding the 1940 National Election. If Commissioner Paul A. Walker, whose term expires next June 30, is not reappointed to the Commission — and there is said to be considerable opposition already in Congress to his selection —, the Telephone Investigation Report may end up by being consigned to the files of Congressional committees and little, if any, consideration will be given to any of its recommendations. This fate, especially, seems certain if the Roosevelt Administration continues its present business appeasement program into next year as a major strategy to win the approval of the electorate in the November, 1940, balloting.

New

The Raytheon RECTICHARGER is the new way of furnishing DC power used by the largest telephone companies to make their service more reliable and to save money.

It is not to be confused with a battery charger.



It supplies the normal load, permits the use of smaller batteries and lengthens their life.

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A RECTICHARGER with a small storage battery floating across its terminals makes a complete, automatic AC-DC telephone power unit. Its DC voltage is stabilized to ±2% at any output even although the AC varies from 95-130 volts. It uses lifetime, dry disc copper oxide rectifying units. There are no moving parts. For full details consult your usual source of telephone supplies or mail the coupon.

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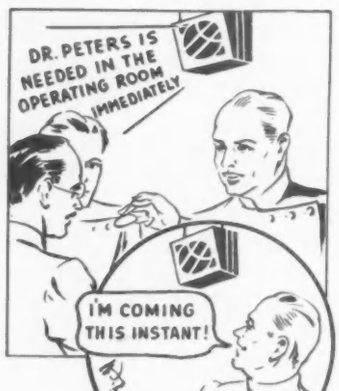

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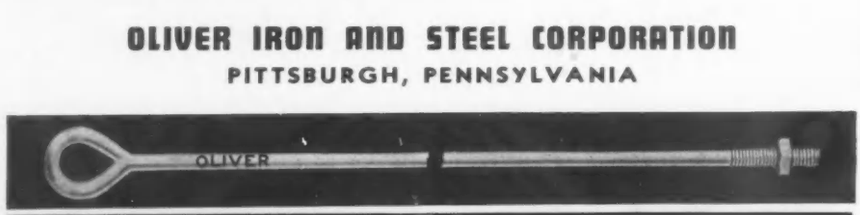

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Uphold Refund to Phone Company

A district court ruling that the Illinois Bell Telephone Co. is entitled to $1,688,295 unclaimed in a refund to subscribers was sustained by the U. S. Circuit Court of Appeals during February.

The refund was made on order of the Illinois Commerce commission. The state, the appeals court ruled, has no claim to the unrefunded amount.

The state had claimed the money principally on basis of English common law which sets forth that all ownerless property belongs to the sovereign. The litigation concerning the refund began in 1923 when the commerce commission ordered the rate reduction. An injunction set this ruling aside temporarily and then the injunction was set aside by the U. S. Supreme court.

The total sum ordered refunded was $18,798,980 collected between the time the commission order was entered and June 11, 1934, the date of the Supreme court reversals of the injunction. This sum includes $4,074,254 in interest.

A. T. & T. Names G. P. Gardner, Jr.

At the meeting of the board of directors of the American Telephone & Telegraph Co. Feb. 15, G. Peabody Gardner, Jr., of Boston, was elected to fill the vacancy caused by the resignation of George Peabody Gardner, who has been a director since 1912.

"Silver Phone" Has Silver Anniversary

Celebrating the Silver Anniversary of the telephone that has been in his home for 25 years, Henry J. Kirchoff, St. Paul, Minn., was honored by the St. Paul Press in its issue of January 1 with an illustration of Mr. Kirchoff using the old "silver phone" which he claims has been trouble-free during these years. It is claimed it is the oldest phone in use in the St. Paul area.

British India Has $8,750,000 Phone Fund

A special five-year Telephone Development Fund of about $8,750,000 has been set up by the Government to finance expansion of the telephone service throughout British India. The immediate program comprises the construction of central offices in various cities and towns, the erection of a second toll circuit between Coimbatore and Shoranur, and the installation of a three-channel carrier system between Bombay-Ahmedad, Bombay-Karachi and Calcutta-Delhi.

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of Gray & Barton

Elisha Gray
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President, Graybar

George E. Cullinan
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GRAYBAR CELEBRATES 70th ANNIVERSARY

THE year 1869 is noted because so many interesting and historical events took place during its twelve months. It was the year when the Atlantic cable was laid; when the golden spike was driven signaling completion of the country's first transcontinental railway; and it marks, also, the genesis of the Graybar Electric Company. It was in 1869 the Gray and Barton Company was formed in Cleveland—and Gray and Barton, the name, became Graybar, the name, just as Gray and Barton, the business, became Graybar, the business.

In 1926, the Western Electric Supply Department changed its name from Western Electric to Graybar. The name Graybar not only was new in its application to the business, but also was generically new, being coined from the original name of the business, Gray and Barton. In 1927, the headquarters of the Graybar Company were moved from the Pershing Square Building to the newly built Graybar Building at 420 Lexington Avenue, which at that time was the largest office building in the world.

The next important date in the history and growth of the Graybar Company was 1929, because on January 1, 1929, the employees of Graybar bought all the common stock of the business and took over ownership as well as control of it. Today, Graybar is one of the largest if not the largest employee owned business in the country.

And now, inasmuch as 1939 marks its 70th Anniversary, Graybar is going to fittingly celebrate it. A comprehensive advertising and sales promotion program has been planned. Trade papers, direct mail, and various promotions are part of the program to acquaint Graybar's customers, prospective customers, suppliers, and employees with its history, its growth and its prospects. In this connection, there will be published a comprehensive and interestingly descriptive book that will detail not only the history of the Graybar Company but also will outline the history of the electrical industry which forms a fitting background for the story of the growth of the company that now bears the name—Graybar. As a part of its anniversary program, the Company plans to hold a nationwide banquet for its employees. These banquets, held on the same day at the same time in the 83 cities in which Graybar has distributing houses, will constitute the highspot of the anniversary campaign in so far as the employees are concerned.

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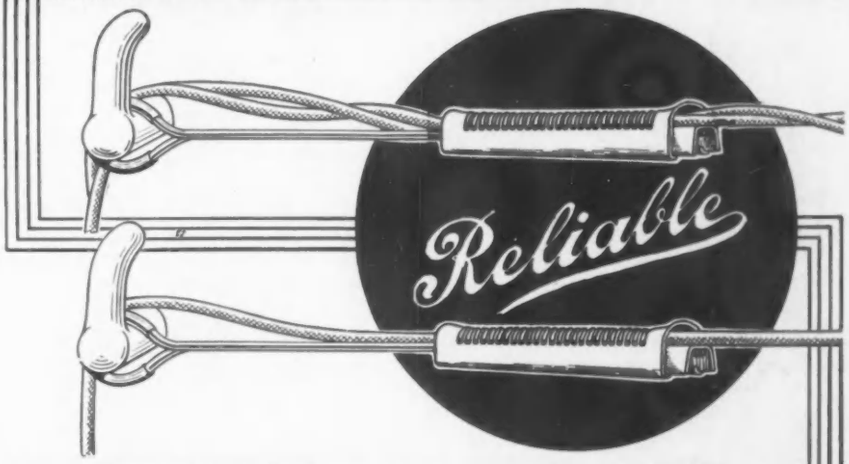

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New Product

When the Paine Company of Chicago demonstrated its "Sudden Depth" drill bit for drilling in concrete, tile and similar materials at the National Convention last October a portable electric drill manufactured by the Independent Pneumatic Tool Company was used as the power unit. Considerable interest was shown by those in attendance in both the bit and the electric drill and additional information was requested by many.

Now, a new light-duty ¼" electric drill, priced very low has just been announced by the Independent Pneumatic Tool Co. The new drill, known as the THOR DRILLMASTER, weighs only four pounds and is but twelve inches in overall length. It is a light-duty tool, designed for general, intermittent service in maintenance and installation work. Bulletin on this product available through the editor.

Data On Tree Pruners Available

Illustrated information is now available from Seymour Smith & Sons, Inc., Oakville, Connecticut, giving latest available data and illustrations on tree pruning equipment. New products are listed and will be of extreme interest to telephone people. Copies of these bulletins may be secured by writing the company.

"WANTED—Young man thoroughly capable of complete maintenance of Strowger dial automatic equipment. Experience in equipment installation desirable. Letter of application should include full details of experience and qualifications." Box 8229 TELEPHONE ENGINEER.

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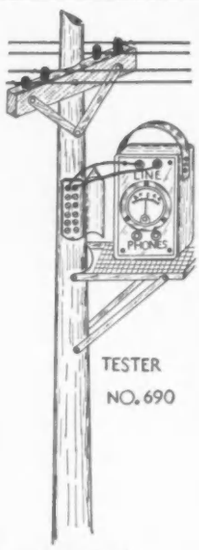

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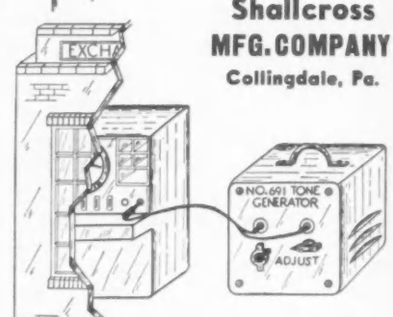

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